The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol. XVIII. No. 3
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MARCH 1921

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New York Office, 1123 Broadway

Relation Between Katathermometer and Thermometer Readings Under Ordinary Indoor Conditions

C.-E. A. WINSLOW and E. L. HEWITT

Characteristics of 85% Magnesia

Curves Showing Most Economical Thickness for Different Conditions

EDWARD R. WEIDLEIN

Functions of the Orifice in Steam and Water Heating

With Results of Tests Made by Bureau of Standards on Modulation Valves

S. HOMER WOODBRIDGE

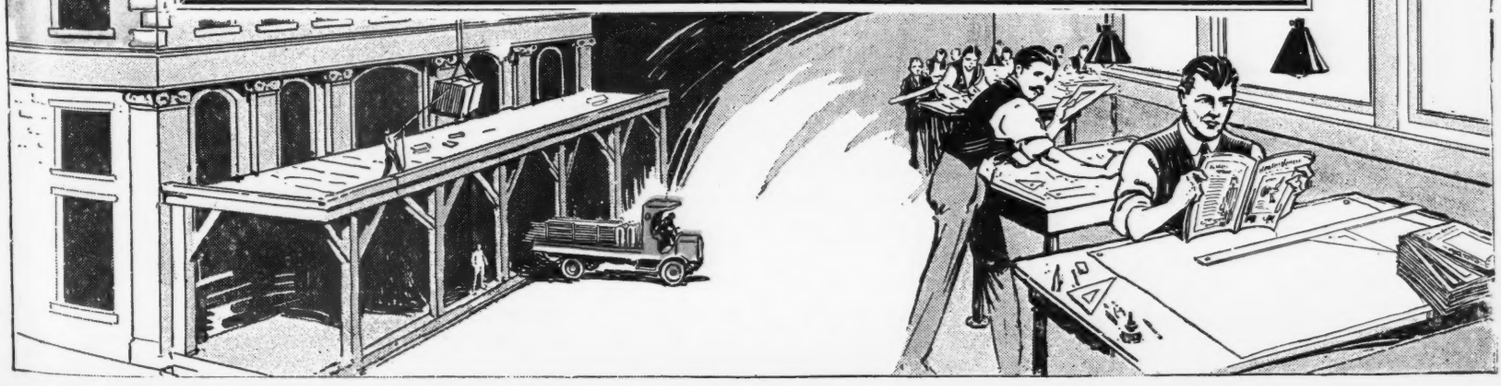
Weather Probabilities for April

REID DAVIES

Instruction Course for Janitors and Custodians

Low-Pressure Steam Heating

EDWIN S. HALLETT



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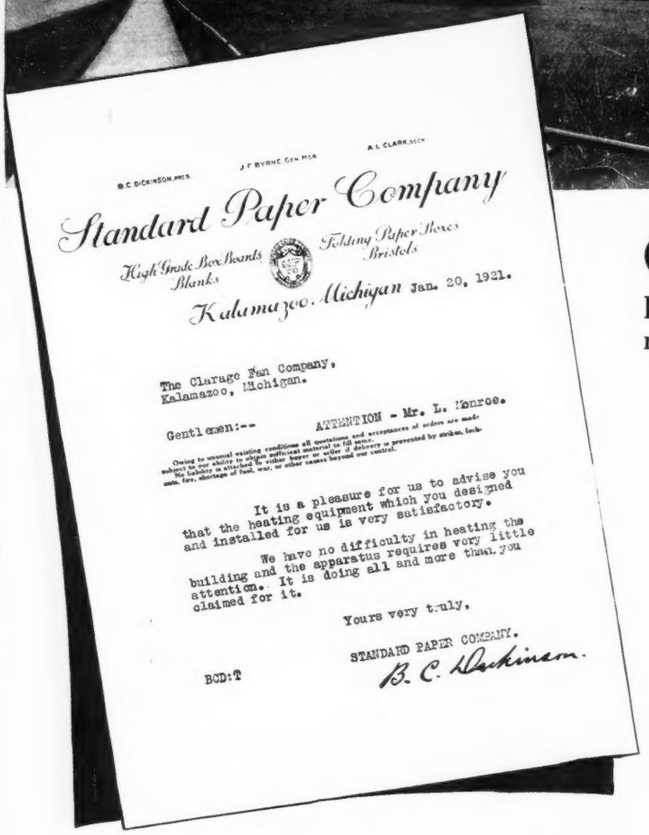
CLARAGE
KALAMAZOO

ONE COST— for Both Heating and Ventilation

A Clarage System was installed over a year ago in this new Paper Box Factory of the Standard Paper Co., Kalamazoo, Michigan. The interior view gives a glimpse of the piping and fresh air outlets. Clarage Engineers designed the entire heating and ventilating system. G. G. Worden of Kalamazoo was the Architect for the building.



B.C. DICKINSON, PRES. J.F. BYRNE, Gen. Mgr. A.L. CLARK, SEC'Y

Standard Paper Company

High Grade Box Boards Blanks — Folding Paper Stocks Bristols

Kalamazoo, Michigan Jan. 20, 1921.

The Clarage Fan Company,
Kalamazoo, Michigan.

Gentlemen:— ATTENTION - Mr. L. Monroe.

Owing to unusual existing conditions all quotations and acceptances of orders are made subject to our ability to obtain sufficient material to fill same.
No liability is attached by us either for non-delivery or delay in delivery or prevented by strikes, lockouts, fire, shortage of fuel, war, or other causes beyond our control.

It is a pleasure for us to advise you that the heating equipment which you designed and installed for us is very satisfactory.

We have no difficulty in heating the building and the apparatus requires very little attention. It is doing all and more than you claimed for it.

Yours very truly,

STANDARD PAPER COMPANY.

B.C. Dickinson.

BCD:T

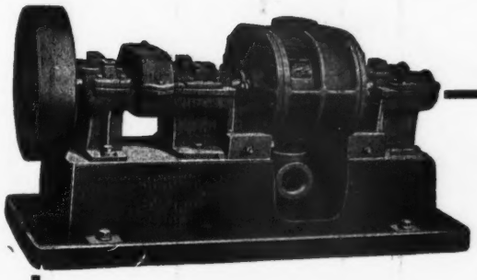
ONE first cost covers both heating and ventilation, if you install a Clarage Fan Blower System. And this cost is not excessive.

With a Clarage System, your workmen have fresh, pure air from out-of-doors the year around —warmed in winter, cool in summer. This good, wholesome air in your factory will keep your workers wide awake and on their toes every minute. Further—the equipment located in one place, offers economy of space, reduces the cost of steam connections, and affords control by one man.

Why not have our engineers cooperate with you on your heating problems? Write, wire or phone us today.

Clarage Fan Company
404-10 Porter Street
Kalamazoo, Michigan

Manufacturers of Fans, Blowers, Heaters, Engines, etc.



Connersville Vacuum Pumps have been installed in the—

State Capitol Bldg., Little Rock, Ark.
Medinah Temple, Chicago, Ill.
Severin Hotel, Indianapolis Ind.
Bureau of Standards Bldg., Washington, D. C.
Vanderbilt University, Nashville, Tenn.
Commerce Bldg., St. Paul, Minn.
Shubert Theatre, Denver, Col.
Lamb Apartments, Houston, Texas.

Satisfaction in Service

Is there anything more gratifying than to buy a machine, install it and then have it perform its operation without causing you worry or trouble?

Connersville Valveless Vacuum Pumps are giving that kind of satisfactory service in many heating plants. You will find them in public buildings, office buildings, theatres, homes, factories—in fact, in all types of buildings.

The Connersville Blower Company

—— Connersville Indiana U.S.A. ——

Chicago, 1431 Monadnock Block New York, 114 Liberty Street

Marsh Reflex Junior Thermostatic Traps

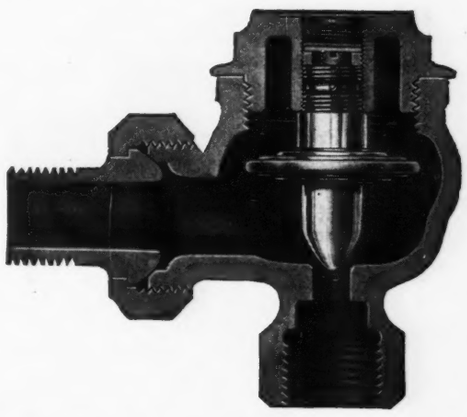
For Radiators and Coils of "Low Pressure," "Vapor" and "Vacuum Heating Systems"

FREELY DISCHARGES AIR AND WATER WITHOUT LOSS OF STEAM

THE Marsh REFLUX Return Line Trap is for use on the return end of radiators of low pressure, vapor or vacum systems of heating. It is the result of a careful investigation into the actual requirements that must be fulfilled by a radiator return valve, in order that it may accomplish what is desired of it, namely, to **free the radiator of air and water without the loss of steam** and to do so **noiselessly.**

The Marsh Reflux Junior Thermostatic Trap is recommended for small radiators and coils. This Trap for the small and the Original Reflux for the large units will make an ideal job. Especially adaptable for two pipe gravity work and vapor systems.

May be furnished either sealed adjustment (as illustrated) or with outside adjustment.



Write for literature fully describing this Trap

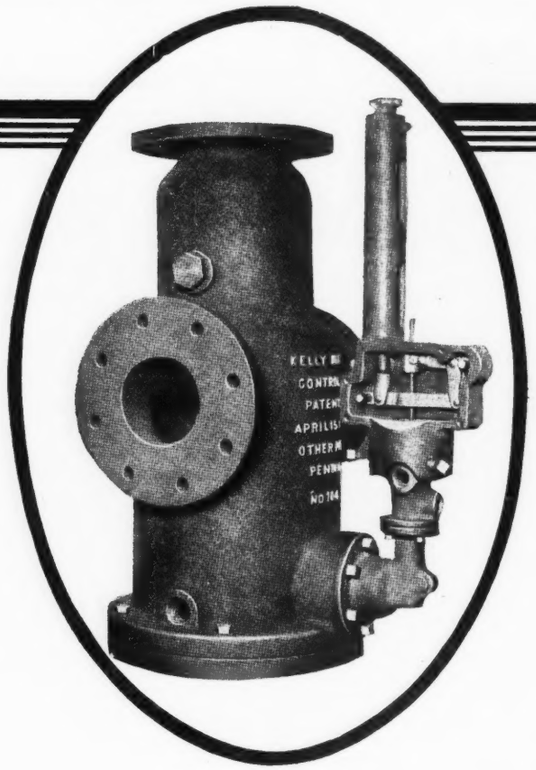
JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

Founded 1865

Manufacturers of Gauges for all Pressures **Automatic Air Valves and Steam Specialties**

Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

Every Cracked Section is a Reason for Kelly Controllers



THE long list of low pressure heating boiler explosions is often a complete surprise to those not familiar with the hidden conditions which threaten the uncontrolled heating boiler.

Cracked sections are, on a smaller scale, explosions. They come from the same source; flash action. When water is syphoned from a boiler as a result of cutting in a large condensing surface, or because a rupture occurs in the steam line, the dry boiler becomes red hot.

As the water slowly returns to the overheated boiler it is flashed into high pressure steam with the result of cracked sections *always*—and often explosions—expense, trouble, and wasted time in either case.

The Kelly Controller ends explosions, and in doing this prevents cracked sections and increases the efficiency of the whole heating system. Any of the branch offices listed below will furnish complete information as to how this automatic device overcomes every condition that threatens heating boilers. Architects can insure efficient operation of heating boilers, with lowest maintenance for the entire life of the boiler, by specifying the Kelly Controller.

These Dangers Threaten every Uncontrolled Boiler

1 Slight surging condition—due to presence of foreign substance in feed water.

The Kelly overcomes this by returning the water which surged over to the boiler through a bleeder pipe.

2 Priming—due to too heavy firing.

This condition is overcome by the controller through automatic temperature reduction.

3 Syphoning—due to a rupture in the steam line or sudden opening of a large condensing surface.

In this case the controller automatically cuts the boiler off, thus acting as a complete safety device.

Awarded that stamp of proven merit, the Fairbanks Company famous "OK"

Manufactured by

THE KELLY CONTROLLER CO.

175 W. Jackson Blvd., Chicago

Distributed exclusively by

THE FAIRBANKS COMPANY

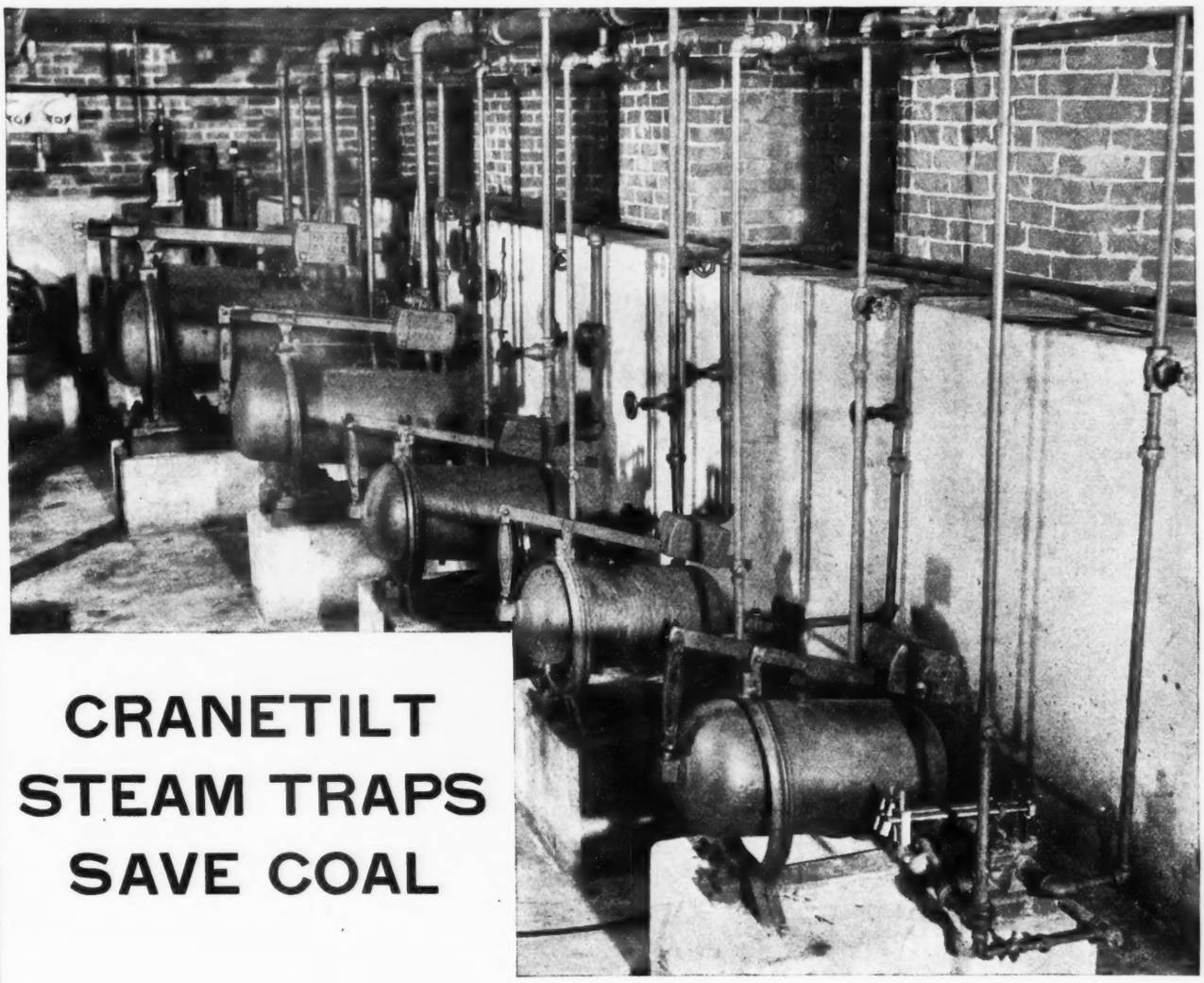
Administrative Offices, New York

Stock carried by following Fairbanks branches:

Albany	Chicago	New York	Scranton
Baltimore	Cleveland	Paterson	St. Louis
Birmingham	Detroit	Philadelphia	Syracuse
Bridgeport	Hartford	Pittsburgh	Utica
Boston	Newark	Providence	Washington
Buffalo	New Orleans	Rochester	

Kelly Controller

"The Boiler Master"



CRANETILT STEAM TRAPS SAVE COAL

The discharging capacities of Cranetilt Traps are greater than any other style trap on the market.

The Direct-Return will automatically return all condensation at any pressure or temperature, directly back into the boiler, and reduce your coal bills.

SALES OFFICES, WAREHOUSES AND SHOWROOMS:

BOSTON
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HARTFORD
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ALBANY
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WICHITA
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FOUNDED BY R. T. CRANE, 1855
CRANE CO.
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WORKS: CHICAGO AND BRIDGEPORT

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LOS ANGELES

CRANE LIMITED — MONTREAL, TORONTO, VANCOUVER, WINNIPEG, LONDON, ENG., SYDNEY, N. S. W., QUEBEC, HALIFAX, OTTAWA, REGINA, CALGARY.

We are manufacturers of about 20,000 articles, including valves, pipe fittings and steam specialties, made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures and all purposes, and are distributors of pipe, heating and plumbing materials.

Model M Cleveoil Burner in a Round Boiler

THE CLEVEOIL BURNER

FOR

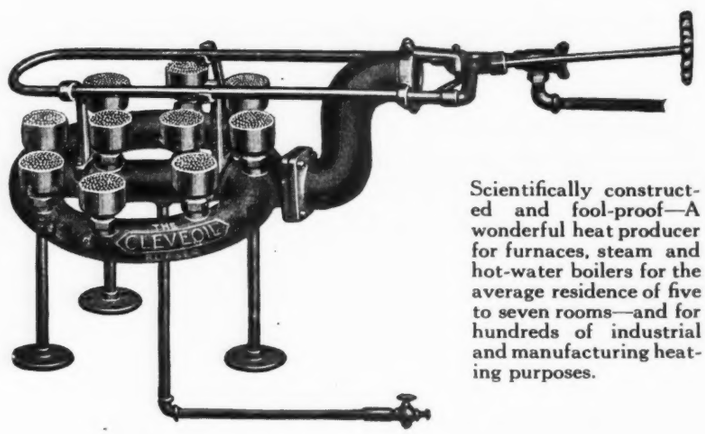
FUEL OIL OR KEROSENE

Produces a clean, even, intense, economical and healthy heat without the inconvenience of ashes, dirt, smoke, soot, carbon or fumes.

DEPENDABLE **EFFICIENT**
ECONOMICAL **DURABLE**

A PERFECT OIL BURNER AT A REASONABLE PRICE

Cheaper than coal or artificial gas.
A perfect orange-blue flame.
No possibility of back-firing.
No clogging of the generator.
A quickly removable generator.
Wide range of vapor control.
All parts interchangeable.
Simple of operation.
Easily installed.



Scientifically constructed and fool-proof—A wonderful heat producer for furnaces, steam and hot-water boilers for the average residence of five to seven rooms—and for hundreds of industrial and manufacturing heating purposes.

Patents pending in the United States and foreign countries

Write us today for literature and detailed information, also our Sales Plan upon "CLEVEOIL" BURNERS

Live DISTRIBUTORS and DEALERS can make large profits from the sale of "CLEVEOIL" BURNERS as well as BARBER PATENTED GAS BURNERS.

PROGRESSIVE MANUFACTURERS of heating appliances should investigate the merits of "CLEVEOIL" BURNERS and adopt them to further the sale of their products.

MANUFACTURED BY

The Cleveland Gas Burner and Appliance Co.

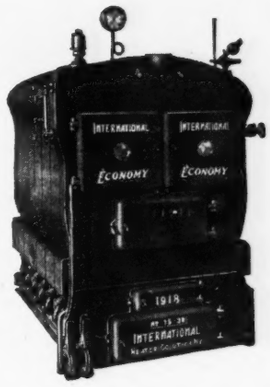
Main Office and Factory: 3702-04 SUPERIOR AVE., CLEVELAND, O.

MANUFACTURERS OF BARBER PATENTED GAS BURNERS

INTERNATIONAL

ECONOMY BOILERS

YOU surely are interested in a boiler which delivers absolutely **dry steam** to the mains without the necessity of an expensive pipe heater. Such a boiler is the **INTERNATIONAL *Economy*.**



This one feature alone means dollars in your pocket on every job. This is only one of its good points.

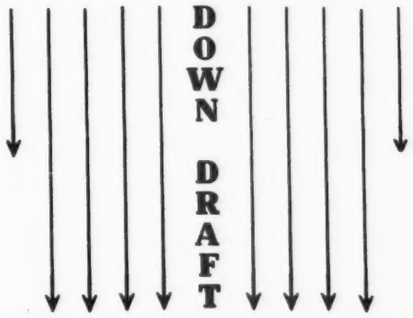
Send for new catalog now on the press which will tell you the whole story.

INTERNATIONAL HEATER CO.
UTICA, N. Y.

BRANCHES: NEW YORK CHICAGO NASHUA, N. H.

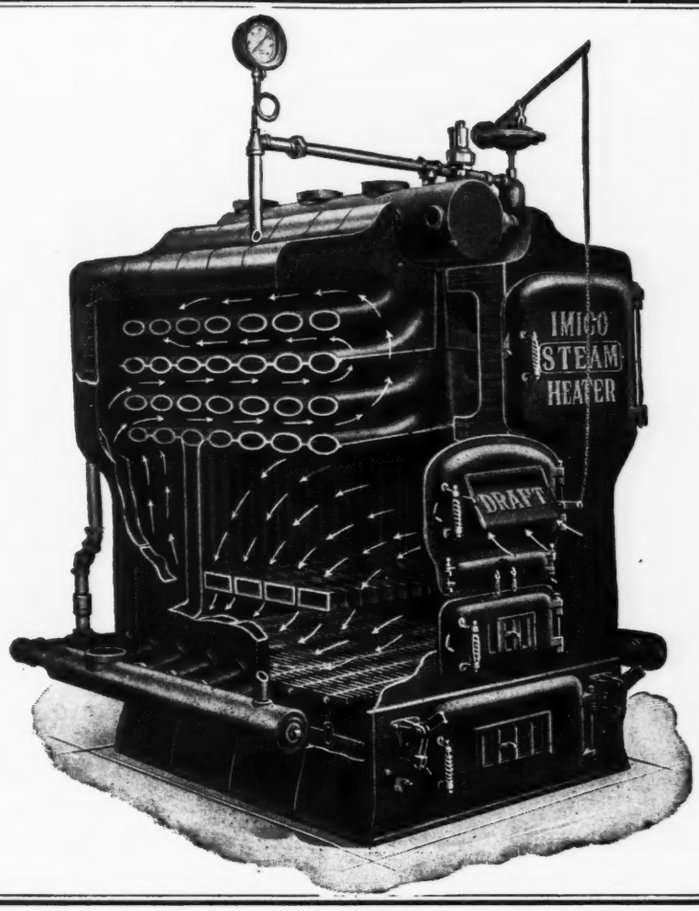
IMICO
Heating Boilers

Smokeless

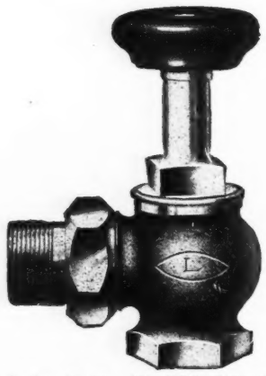


For Water or Steam

Our Catalogue describing our complete line of Heating Apparatus sent on request



Illinois Malleable Iron Co.
Chicago



Lavigne Packless Wood Wheel Handle

CORRECTLY ENGINEERED

Valves are a very important part of any steam or vapor heating installation and it is highly essential that they be correctly designed for the service they are called upon to render.

LAVIGNE PACKLESS QUICK—OPENING STEAM RADIATOR VALVES

have been tested by a great many years of strenuous service and the engineering principles involved in their construction have been proven absolutely correct.

These valves Positively do not leak air, water or steam
Open quickly and close just as quick. Are correctly proportioned and properly manufactured.

BUILT RIGHT———TO STAY RIGHT

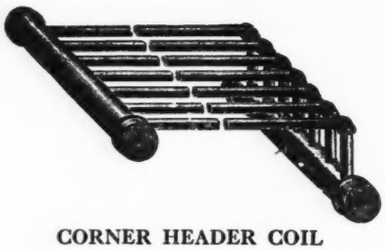
Made in six sizes, many styles of handles—All good jobbers handle them.

COMMONWEALTH BRASS CORP. DETROIT, MICH.

JOHN SIMMONS CO

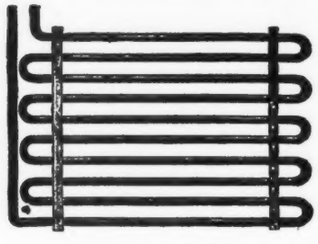
110 Center Street, New York

PIPE COILS and BENDS



CORNER HEADER COIL

PLAIN SPIRAL COIL

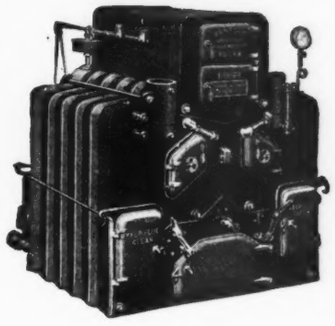


ZIGZAG COIL

We bend up to 16" and weld. Van Stone up to 36" Pipe. No job too difficult. First-class material and workmanship. We are specialists in this line and solicit a trial on your requirements. Prompt service.

Send Today for Our Coil Folder

Sales Representatives



In point of Steady Delivery of Heat for Long Periods, Economy in Fuel Consumption, Infrequent Attention and Adaptability to Different Sizes and Kinds of Fuel, the best engineers agree that

The Newport
automatic feed
BOILER

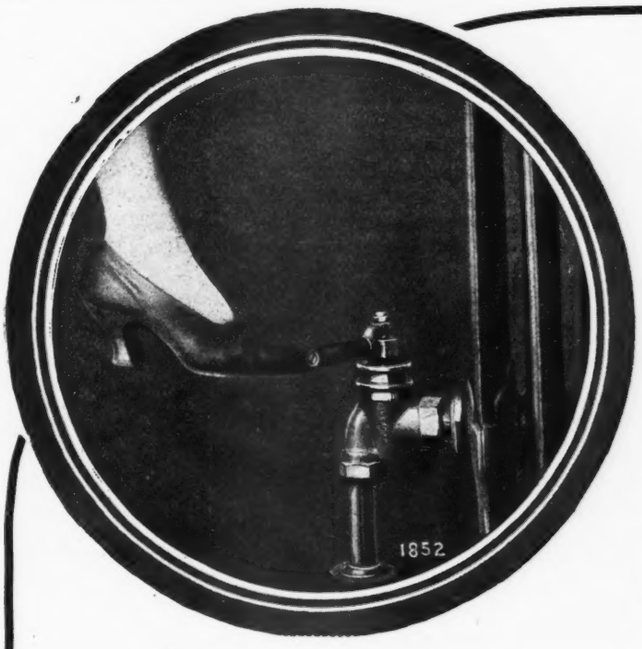
is really the most scientific heater. Its performance has been so consistently reliable throughout the past eight years that the thought of highest praise only enters the minds of thousands of owners.

Many sales agents have taken advantage of the opportunity to build for themselves a permanent and profitable business with the magazine feed boiler which has an established reputation for superior selling advantages.

You, too, can control an exclusive sales territory on a liberal commission basis. Write for our proposition giving full information regarding your sales methods, lines handled and territories covered.

NEWPORT BOILER COMPANY

107 S. Dearborn St., Chicago



No stooping, the slightest touch of the foot operates the valve

A Quarter Turn of the Handle Opens or Closes the GORTON QUARTER-TURN VALVE

It is the easiest operating valve in the world, and users will regulate heat in a room by opening and closing the radiators, saving steam.

With the old time valve requiring five or six turns of the wheel to open or close the valve users open the windows to cool a room, an immense waste of steam.

Wasted steam is wasted coal.

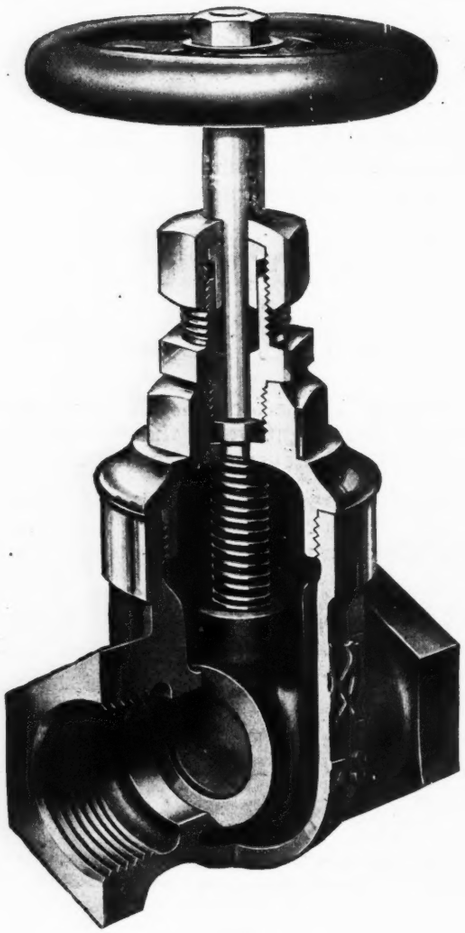
Equip your radiators with Gorton Valves and save money on your Coal Pile.

Write for Catalogue

Gorton & Lidgerwood Co.

FISHER BLDG., CHICAGO, ILL. **100 LIBERTY ST., NEW YORK, N. Y.**

See Sweet's Architectural Catalogue, Page 1757, for Specifications



You don't have to worry about the inside of

KENNEDY VALVES

They are made to last and they *do* last

MEMBERS THE NATIONAL TRADE EXTENSION BUREAU OF THE PLUMBING AND HEATING INDUSTRY. PERMIT No 76 REGISTERED.

214

THE KENNEDY VALVE MFG. CO. ELMIRA, N.Y.

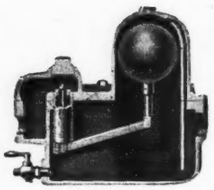
Branch Offices and Warehouses:

NEW YORK: 95 John St. BOSTON: 47 India St.
SAN FRANCISCO: 23-25 Minna St. CHICAGO: 204-8 N. Jefferson St.

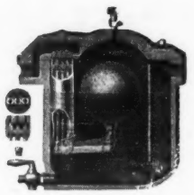
EXPORT OFFICE: 95 John St., New York City

SALES OFFICES:

Philadelphia, Continental Hotel Bldg. Salt Lake City, 503 Dooly Bldg.
Kansas City, 208 Mutual Bldg. El Paso, 704 Two Republics Bldg.
Seattle, L. C. Smith Bldg. Portland, Ore., Railway Ex. Bldg.
Winnipeg, Can., Chamber of Commerce Bldg.



Wright "Victor" Trap



Wright "Emergency" Trap

WA Standard with STEAM USERS SINCE '94

Guaranteed "Steam Savers"

Wright-Austin Steam Specialties are guaranteed.

Any one of our "steam savers"—including steam and oil separators, strainers, pump governors, boiler feed regulators, safety water columns, steam traps, exhaust heads and grease traps—will be sent you for a thorough trial. If not satisfied, return and we will pay freight both ways.

Let us send you complete information about the Wright "Emergency" High Pressure Steam Trap and the "Victor" Low Pressure Trap.

Because it assures a constant flow of dry steam, the Wright "Emergency" Trap has been found invaluable for increasing the efficiency of heating equipment.

Large or small quantities of condensation, under absolutely no pressure—and up to 20 pounds—are discharged through one large valve by the "Victor" Trap.

Let us send you the Wright-Austin Catalog. It has pages on traps and their operation.

Wright-Austin Company

76 Woodbridge Street

DETROIT MICHIGAN

Branch Offices:

New York Chicago Boston

Representatives Everywhere

(16)

Prices Smashed:
$75 Steam Traps now $30
Satisfaction Guaranteed

Don't miss this unprecedented opportunity to get absolutely new high grade steam traps at less than the cost of manufacture

If you saw an advertisement like the above, wouldn't you jump at the chance to save $45 each on steam traps? Of course you would. So would every shrewd business man.

That is precisely what we are offering you in the Steam Trap Sarco. You can get a 2" size for $30 instead of the $75 price asked for other traps of the same size. And there is as large or larger reduction in the cost of other sizes.

STEAM TRAP
SARCO

does all that the more cumbersome, high-priced bucket or float type of traps do, yet costs about ⅓ as much.

You can get the Sarco at this low price because it has no expensive, complicated parts like levers, gauges and stuffing boxes, and is operated by the expansion and contraction of a reliable fluid. It is simplicity itself, having only one moving part.

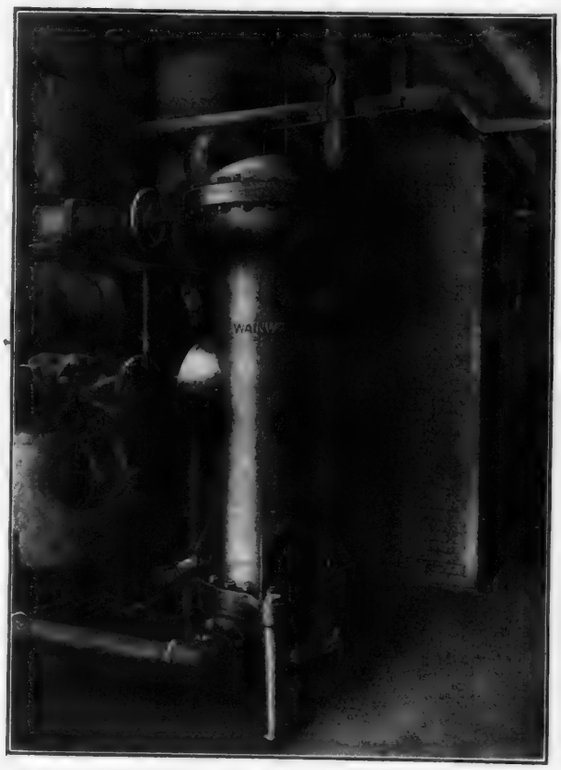
You also save in installation cost with the Sarco. It can be installed at any point on the line, at any angle without change of piping. No need of going to the expense of building a platform or supports or of wasting valuable floor space.

The Sarco will drain condensate as soon as it gathers, and return it to the hot well while still hot. It will not leak live steam.

We ship the Sarco on 30 days' free trial so you can see for yourself that it will do all we claim. How many shall we ship to you on this basis? You may have any size from ⅜" to 3", at any given pressure up to 200 lbs. Booklet P-12 on request.

SARCO CO., INC.
231 Broadway, New York
Buffalo Chicago Cleveland Detroit Philadelphia

"Wainwright"
Hot Water
Service Heaters



The essential features of these heaters are detailed in Bulletin which will be sent on request.

Straight tubes, separate water channels, tube heads and covers make cleaning easy. Dependable temperature control is furnished with heater, if desired, recommending these equipments for the most severe service conditions.

We also manufacture Centrifugal Pumps either motor or steam turbine driven adaptable for circulating or pressure service on either hot or cold water systems.

Bulletin on Request

ALBERGER PUMP & CONDENSER CO.
140 Cedar Street, New York
Boston Chicago St. Louis Philadelphia

Every Smokestack is a Prospect

At the bottom of almost every smokestack some kind of pumping equipment is used or should be used in the interest of efficient and economical operation.

In many cases a pump would save the owners of these smokestacks a great many dollars a year by putting back into the boiler condensation that is now wasting to the sewer or by quickening the circulation of hot water plants.

Established

LA CROSSE TRANE WISCONSIN

1883

Trane Pumps dependably meet these needs. They are reasonable in price, simple in construction, proven in performance. They are made in a wide range of sizes, and for both high and low pressures. Let us tell you more about them.

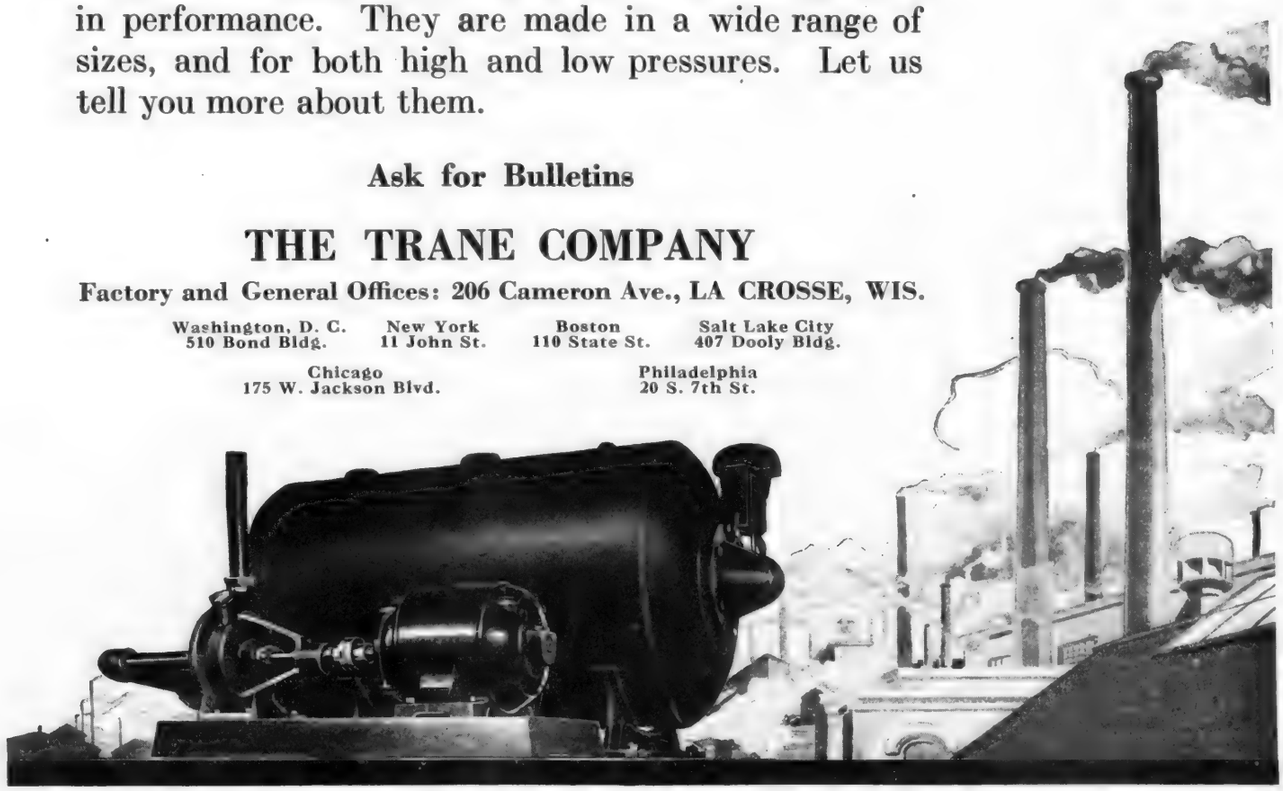
Ask for Bulletins

THE TRANE COMPANY

Factory and General Offices: 206 Cameron Ave., LA CROSSE, WIS.

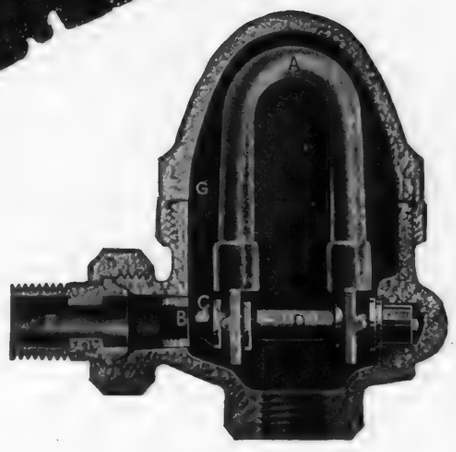
Washington, D. C. 510 Bond Bldg. | New York 11 John St. | Boston 110 State St. | Salt Lake City 407 Dooly Bldg.

Chicago 175 W. Jackson Blvd. | Philadelphia 20 S. 7th St.



TRANE PUMPS

VENTO



VENTO Return Line Valve, for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed.

VENTO is thermostatic in its operation and so simple that no part of it can possibly get out of order; so sensitive that a slight change of one degree in temperature will start the valve in operation.

VENTO automatically discharges air and water without loss of a particle of steam. It is by far the most efficient valve for its work ever produced.

Return Line Valve—

It will exert more power and give a greater movement than any other thermostatic device in use. VENTO has proved more than a friend to thousands of heating men who found in it the solution of the most of their troubles.

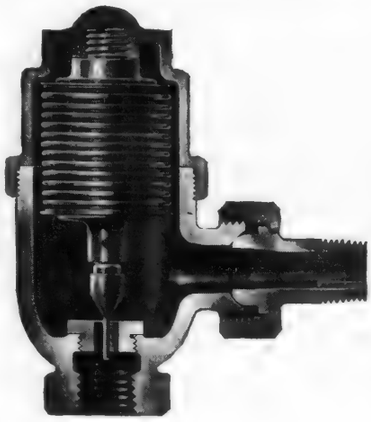
Our latest Booklet "The Perfect Heating System," will be mailed on request to any heating engineer.

WM. S. HAINES & COMPANY
Philadelphia

6

Webster
ESTABLISHED
-1888-

STEAM HEATING SYSTEMS AND APPLIANCES



The Webster Sylphon Trap — the recognized standard for efficient radiator service with most economical use of steam.

WEBSTER Systems of Steam Heating are providing economical warmth in thousands of public, semi-public and private buildings of every size and type throughout the country. Thirty-three years of leadership in steam heating system improvements have made WEBSTER equipment the recognized standard today. And Webster Service assures architect, engineer, contractor, and owner hearty and thorough cooperation in making each Webster installation a complete success and a credit to all concerned.

In order to help extend the benefits of Webster equipment, the Webster Sylphon Attachment has been developed to replace the faulty mechanism of unsatisfactory return traps of other make that may be impairing radiator effectiveness. The changeover is made quickly, conveniently and at small cost.

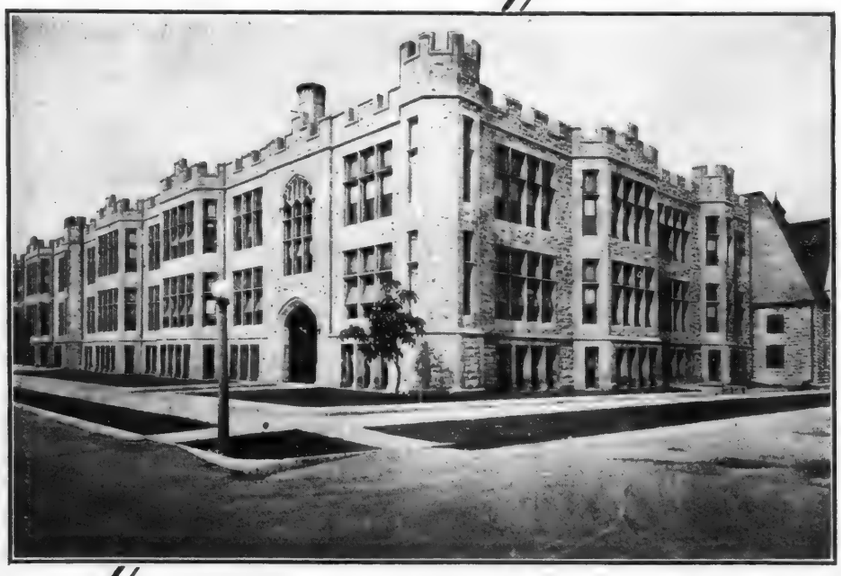
Write for Bulletins

86

WARREN WEBSTER & CO.
Main Office and Works: CAMDEN, N. J.

Offices in All Principal Cities

CONNERSVILLE
VACUUM CLEANING SYSTEMS



TOWNSHIP HIGH SCHOOL
and
JUNIOR COLLEGE
Joliet, Illinois

For school building use, where a large amount of dirt must be removed from bare floors in a short time, Connersville Vacuum Cleaning Systems are most desirable.

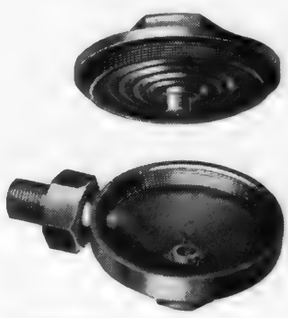
A six sweeper plant keeps this building clean and sanitary.

There is a Connersville system for any sized building, and of any sweeper capacity.

LANDERS, FRARY & CLARK
United Vacuum Appliance Div.—Dept. C
CONNERSVILLE - - INDIANA

Tinning the disc before soldering it.

The Dunham Radiator Trap consists of two major parts, a body and a cover holding the thermostatic disc.



Sturdy Simplicity

In what has been said to be one of the most modern machine shops west of the Mississippi, Dunham Traps are made with extreme care and accuracy.

The result is *sturdy simplicity*. Nothing could be more simple than the two-piece Dunham Trap; and judging from service records of those in use since 1903, Dunham sturdiness is exceptional.

The Dunham Radiator Trap maintains a radiator at its maximum heating efficiency by permitting the passing of all air and water from the radiator and holding all steam within the radiator until it gives up its heat.

Complete data on request.

Dunham Specialties

Packless Radiator Valves
Radiator Traps
Drip Traps
Blast Traps
Air Line Valves
Vacuum Pump Governors
Reducing Pressure Valves
Oil Separators
Suction Strainers
Air Vents
Return Traps
Check Dampers
Damper Regulators

The DUNHAM
REG TRADE-MARK
HEATING SERVICE

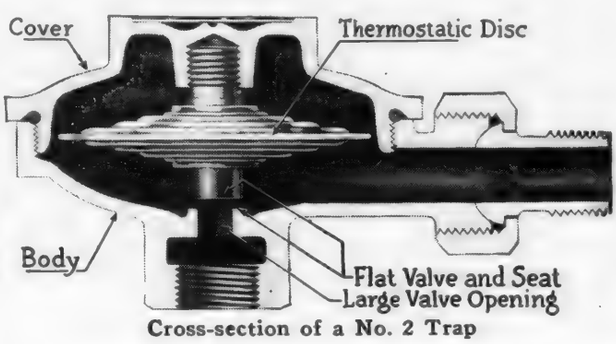
C. A. DUNHAM CO., Fisher Bldg., CHICAGO

Factories: Marshalltown, Iowa; Toronto, Canada

52 Branch and Local Sales Offices in the United States and Canada

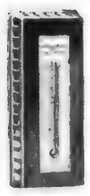
London: 233 A, Regent Street, W. 1

Paris: Establts. Munzing & Cie., Rue de la Fontaine-au-Roi



Cross-section of a No. 2 Trap

The Cleveland Hotel, Cleveland, Ohio



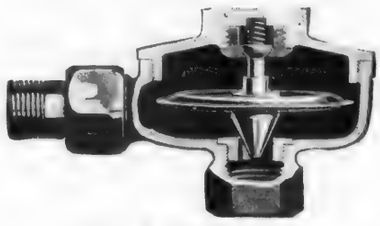
B. & B. Thermostat

used THE BISHOP & BABCOCK VACU-TRAPS and TEMPERATURE CONTROL SYSTEM.

These have been selected after thoroughly investigating the operation of same in representative installations throughout the country.

In putting on the market The B. & B. Line of Heating Specialties it has been our aim to give the steam user the very best and latest in steam, water and air controlling and regulating valves made. Only the very highest grade of materials and only the very highest type of skilled labor are employed in their manufacture.

Let us send our BULLETINS to you describing The B. & B. Line of Heating Specialties complete.



B. & B. Vacu Trap

THE BISHOP & BABCOCK COMPANY

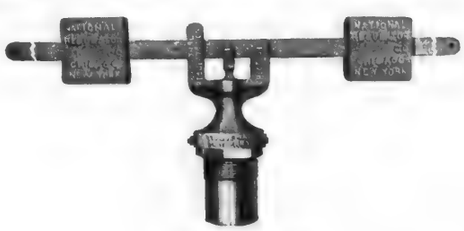
General Offices and Factories, CLEVELAND, OHIO.

The B & B Line

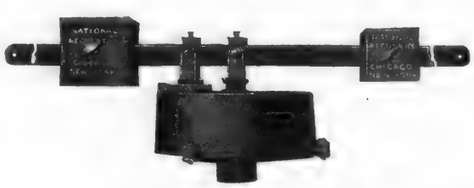
MANUFACTURERS OF

The B. & B. Vacuum Systems
The B. & B. High and Low Pressure Steam Specialties
The B. & B. Temperature Control
The B. & B. Vacuum Pumps
Miscellaneous Heating Specialties

HOT WATER LOW PRESSURE



2" for Hot Water



7" for Low Pressure and Vapor

Made in 2", 4", 7" and 10" sizes

One for Every Duty & Duty for Every One

handling boilers to see that they are equipped with sensitive, powerful and durable regulators. Metaphram means the best metallic Regulator made.

TRADE METAPHRAM MARK REG U.S. PAT OFFICE

NATIONAL REGULATOR CO.
FACTORY AND GENERAL OFFICES
208-212 South Jefferson Street
CHICAGO

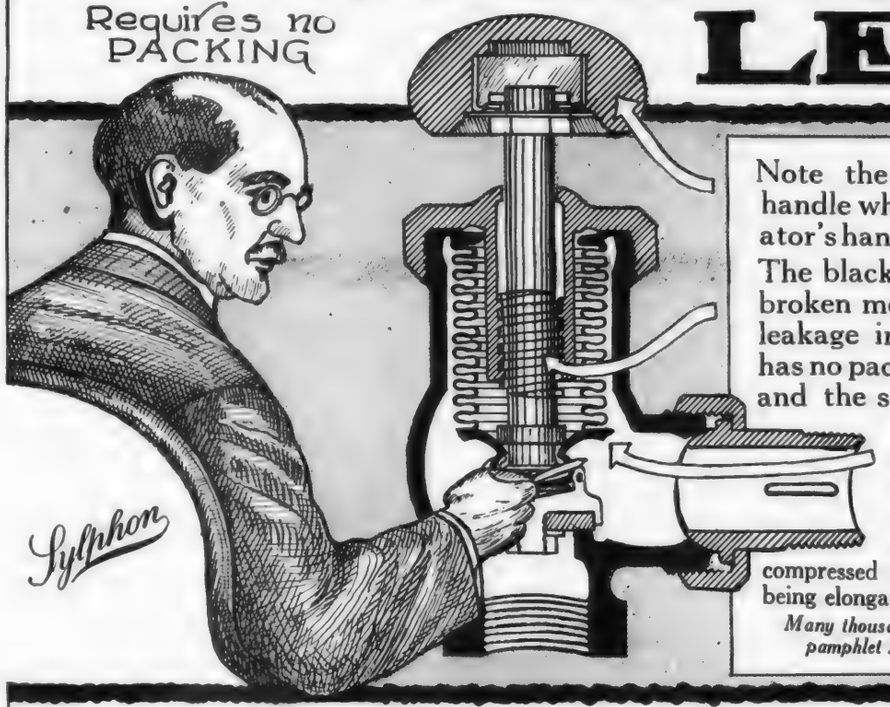
VAPOR

A-JACKS for HIGH PRESSURE

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

A Valve that cannot LEAK

Requires no PACKING



Note the construction of the handle which prevents the operator's hand from being burned. The black outline shows the unbroken metal wall which makes leakage impossible. The valve has no packing of any descripton and the stem and stem support are inside of an absolutely tight Sylphon. This Sylphon is a one piece, all metal, expansible member which is capable of being compressed as the stem arises and of being elongated as the stem descends.

Many thousands in daily use. Send now for pamphlet ZPVI. "It's worth reading."

THE FULTON COMPANY
KNOXVILLE TENNESSEE U S A.

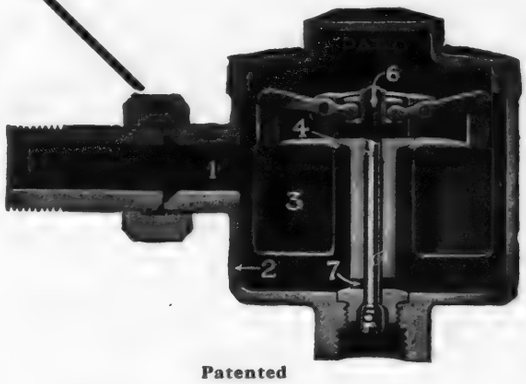
New York Office
1476 Broadway

Chicago Office
175 W. Jackson Blvd.

Detroit Office
1247 Wash. Blvd.
Book Bldg

A Steam Trap that Automatically Eliminates Air and Water Condensation Without Allowing Escape of Steam

THE McDonald Under-Seat Valve is the only valve of its kind on the market. The principle of operation is positive and noiseless. It gives perfect service on any radiator on a two-pipe heating system and under any ordinary pressure up to ten pounds. Handles and discharges a much larger quantity of water than any other trap or valve of equal size. Self-cleaning. Carries away all scale. Entire inside instantly removable by loosening cap. Saves every ounce of steam. Its economical features are greatly appreciated by the building owner.



Patented

Leading architects, heating engineers and contractors are specifying and installing large numbers of the McDonald Under-Seat Valve, because its superior features bave been proven in service.

Write for detailed information

The McDonald Under Seat Valve Co.

602 Swetland Building CLEVELAND, OHIO

AMERICAN-LARSON SUCTION VENTILATOR

A Better Ventilator

FROM both the standpoint of greater ventilating *effectiveness* and lower ventilating *costs*, the American-Larson is well worth looking into.

The remarkable exhaustive power of this ventilator is due partly to the siphon action of the ejector tube and partly to the easy curve of the discharge.

Notice the design. There are no sharp angles of exhausts. The discharged air has an easy upward course. The ejector tube in the rear catches the full force of the breeze as the vane keeps this opening constantly presented to the air.

It gets a greater drawing power from the air-current at the discharge opening plus the force of the air-currents passing through the ejector which acts as a strong siphon, drawing the impure air always in an upward (thus natural) tendency to the open air. Its action is similar to that of an atomizer.

It offers the least possible obstruction of the air-flow. It is the most effective ventilator in light or heavy breezes.

What It Will Do

IT is most efficient, harnessing the breeze to induce an updraft, and will exhaust more air for less money.

It will remove heavy fumes and steam heretofore requiring power ventilation.

It is noiseless, storm proof and requires no attention, for it is mechanically perfect and pivots freely when it comes to you and keeps on doing so for its full life.

It will not backdraft even under the most unfavorable conditions.

We invite investigation of this statement—the exhaust capacity of the American-Larson is double that of any other ventilator, which means that half the number of these ventilators are required to do a given work at half the expense.

Our literature will be of value to your files.

Address Department H

THE
MARTIN BUILDING AMERICAN VENTILATING COMPANY PITTSBURGH PENN. U.S.A.

MIST

in Air Washers

IN MEL-ROCK AIR WASHERS each Mist Nozzle produces a greater volume of mist at a low pressure, thus saving power and money.

Mel-Rock Eliminators are built in batteries at the factory. Setting up and taking down are a simple, time-saving and money-saving process.

Each capacity of air washer is built in from 4 to 7 sizes and proportions, so that any space and head room may be accommodated.

MEL-ROCK is the Modern Air Washer

Send for new descriptive catalog

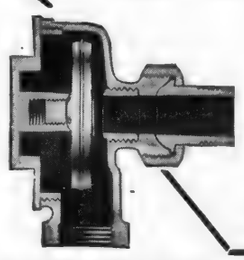
MEL-ROCK PRODUCTS TRADE-MARK

MELLISH-HAYWARD COMPANY
213 W. Austin Av.
CHICAGO

The "IDEAL" Trap

IN NAME - IN PRINCIPLE - IN SERVICE

For all Return Line Heating Systems—Vapor, Vacuum or Straight Steam



1. Fool Proof.
2. Less Complicated.
3. A "Protected" Diaphragm.
4. Vertical Self Cleaning Seat.
5. Highest Radiator Efficiency.

Ideal Heating Equipment Co.
1897 E. 90th St. Cleveland, Ohio

STERLING SYSTEMS

STERLING SYSTEMS

Vacuum and Vapor Heating Specialties

Thermostatic Traps—Air Line Valves—Graduated Supply Valves—Air Eliminators—Damper Regulators—Return Traps

STERLING ENGINEERING COMPANY
Milwaukee Wisconsin

ADVERTISING

By DR. FRANK CRANE

(Copyright by Frank Crane)

ADVERTISING is the greatest business in the world. That is not because it enables business people to sell more goods, not because it is a way to make great profits. Nothing can be really great for any purely dollars-and-cents reason.

It is because, in advertising, business becomes vocal. When, in the course of evolution, the animal acquired speech and became able to utter himself, he had made the longest stride in development. He had stepped from brute to man.

The human soul dates back to the first word. "In the beginning was the Word."

Advertisement is the utterance of human energy. Craftmanship is good, and industry, and organization, and business ability; but they are dumb giants until they find speech—dumb and dangerous.

Business, including manufacturing, farming, transportation, and selling, is to the new world what fighting was to the old. The old world organized only to kill, and its genius was displayed by great generals. Its heroes were the mighty killers. To them it set up its statues.

The new world, typified by, led by America, is organized to serve, to make human life richer, deeper, stronger, more complex more heterogeneous.

And business is simply service. Business comes to itself, attains maturity and full self-expression only through advertising.

Advertising is the breath of life breathed into the nostrils of business, by which it becomes a living soul.

Thus advertising not only enlarges business; it radically changes the nature of business.

By it business passes from bureaucracy and autocracy into democracy. It takes the whole people into its growth. It enters the veins of the commonwealth. It becomes a function of communal life.

Without advertising comes decay and death.

Nations need advertising. If they would advertise they would prevent war. War is the self-expression of dumb brute force. *Advertising is the self-expression of intelligent strength that knows how to speak.*

It is the something plus in advertising that is significant. It is this something plus that makes advertising to business what art is to handiwork, what music is to feeling, what language is to the soul.

LIST OF MEMBERS

Each has subscribed to and is maintaining the highest standards of practice in their editorial and advertising service

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American Architect
American Blacksmith
American Exporter
American Funeral Director
American Hatter
American Machinist
American Paint Journal
American Paint and Oil Dealer
American Printer
American School Board Journal
Architectural Record
Automobile Dealer and Repairer
Automobile Journal
Automotive Industries

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Bulletin of Pharmacy

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Farm Implement News
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Fire and Water Engineering
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Motor Truck
Motor World

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National Druggist
National Petroleum News
Nautical Gazette
Northwest Commercial Bulletin
Northwestern Druggist
Nugent's, The Garment Weekly

Oil News
Oil Trade Journal

Plumber and Steam Fitter
Power
Power Boating
Power Farming Dealer
Power Plant Engineering
Price Current—Grain Reporter
Printer's Ink

Railway Age
Railway Electrical Engineer
Railway Maintenance Engineer
Railway Mechanical Engineer
Railway Signal Engineer
Retail Lumberman
Rubber Age and Tire News

Shoe Findings
Shoe and Leather Reporter
Shoe Retailer
Southern Engineer
Southern Hardware and Implement Journal
Sporting Goods Dealer
Starchroom Laundry Journal

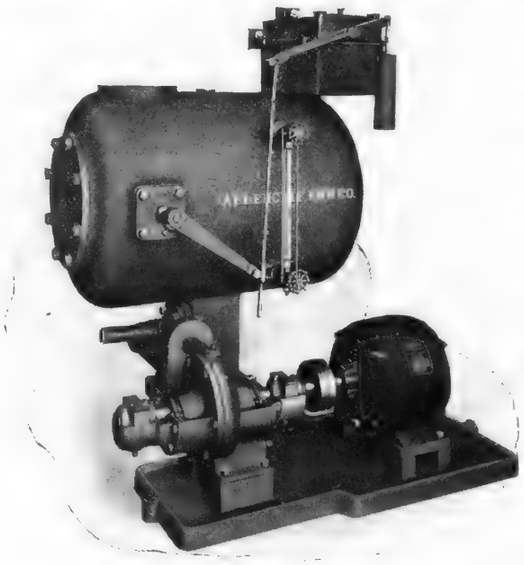
Tea and Coffee Trade Journal
Textile World Journal

Welding Engineer
Woodworker

THE ASSOCIATED BUSINESS PAPERS, INCORPORATED
HEADQUARTERS - - 220 WEST 42nd STREET - - NEW YORK

USE "ALLENCLIF" AUTOMATIC CONDENSATION UNITS

FOR CONTINUOUSLY SATISFACTORY SERVICE



NO STICKING OF SWITCH-OPERATING PARTS; ALL BRASS.

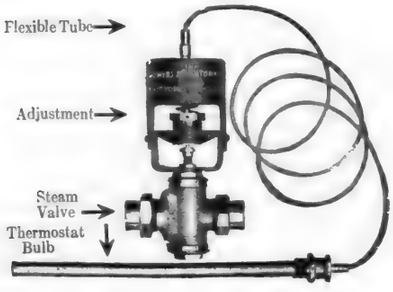
NO CORROSION OF SHAFT; IT IS MADE OF MONEL METAL.

NO BEARING TROUBLE; THEY ARE BRONZE AND RING OILING.

PUMP AND MOTOR WILL STAND UP UNDER CONTINUOUS OPERATION.

THE ALLENCLIF ENGINEERING COMPANY

638 E. LIVINGSTON AVE. WRITE FOR BULLETIN No. 2 COLUMBUS, OHIO

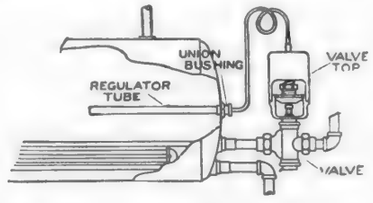


The Powers Regulator No. 11

Hot Water Control

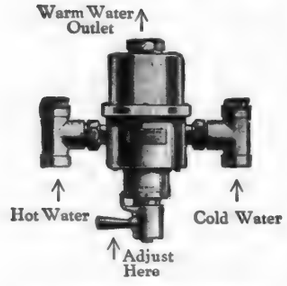
The Powers No. 11 Automatic Thermostatic Regulator is an absolutely reliable controller for steam heated hot water service. It is an accurate regulator of the self-contained type, used for the control of liquid temperatures, and has a great variety of applications. Water Cooling, Water Heating, Steam Cookers, Pasteurizers, Hot Water Tanks, Water Cooling Tanks, Feed Water Heaters, etc., are all made automatic by its use.

For further details, prices, etc., ask for Bulletin 129.



Typical Installation of No. 11 Regulator on Steam Heated Hot Water Service Tank. Installation expense is practically nothing.

Shower Bath and Hot Water Line Control



The Powers Water Controller

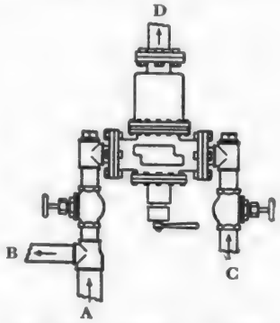
The Powers Thermostatic Water Controllers are true thermostatic mixers, and should not in any way be compared with the numerous mechanical mixers and so-called anti-scald valves on the market.

The Powers water Controllers are the last word in safety and economy. Over heated water cannot pass through them. If either hot or cold water fails, the entire flow is automatically shut off.

FOR SHOWER BATHS, single or in gangs, these controllers assure the delivery of water at the desired temperature. Adjustment is simple; at the pleasure of the bather, or fixed and locked as circumstances dictate.

Ask for Bulletin 124, giving further details and prices.

For the hot water line, a Powers Water Controller properly installed prevents extremely hot water from going to the bath room, thus saving wear and tear on the fixtures, but permits the kitchen and laundry to take it as hot as may be desired. Drawing at right illustrates this.



Hot water entering at A passes, at its original temperature, through B to Kitchen and Laundry, also entering mixer, where it thermostatically combines with cold water which enters at C and is discharged to Bath Room line D at desired temperature.

1548

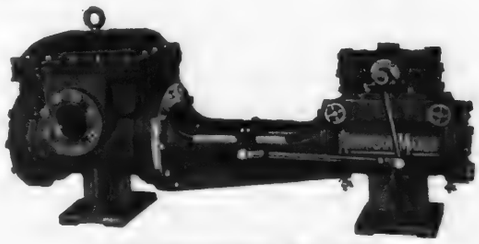
The Powers Regulator Co.
Specialists in Automatic Heat Control

954 Architects Bldg. New York
2718 Greenview Avenue Chicago
565 Boston Wharf Building, Boston
The Canadian Powers Regulator Co., Ltd., Toronto, Ont.

American-Marsh Pumps

for Heating Systems

For use in returning the condensation to the boiler on heating systems where the steam pressure is too low to operate a steam pump. Water is returned to the boiler in its hottest state. Equipped with an automatic float valve which is positive and reliable.



The Recognized Standard

American-Marsh Vacuum Pumps have been recommended and specified by a majority of the leading heating engineers and Contractors for over twenty years.

Made with only best of material and workmanship. Highest efficiency guaranteed.

Equipped with an improved steam valve which is especially adapted for vacuum service. American-Marsh Pumps are positive in action, possess a perfect governing element and will not hang up under all the varying conditions.

Ask for Bulletins Nos. 24 and 27

AMERICAN STEAM PUMP CO.
Battle Creek, Mich.

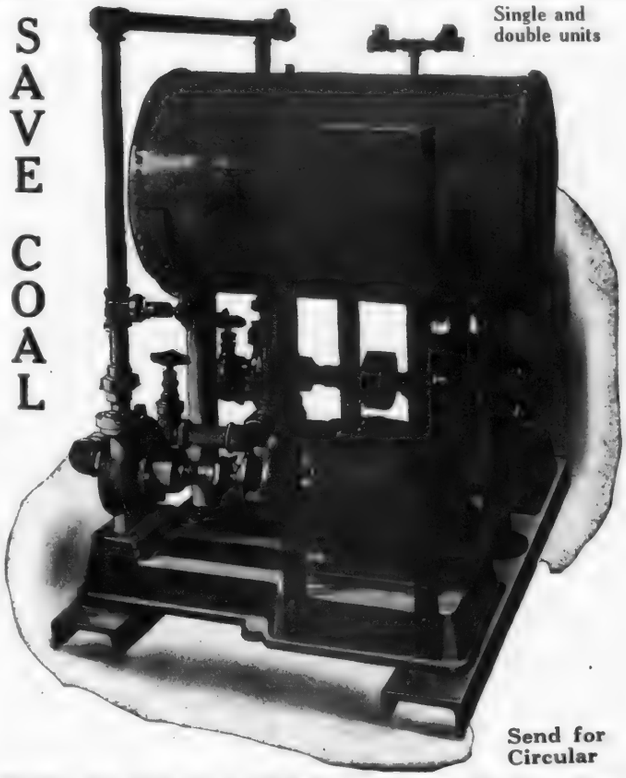
Our slogan: Simplex not Duplex. "To be simple is to be great"

THE THOMAS AUTOMATIC CONDENSATION UNITS

of all descriptions and sizes

Single and double units

SAVE COAL



Send for Circular

THOMAS PUMP WORKS, 154 Spring St., New York

DU MOIN
Automatic Condensation Pump and Receiver

Takes care of the returns, either above or below the floor line, in vapor or gravity systems.

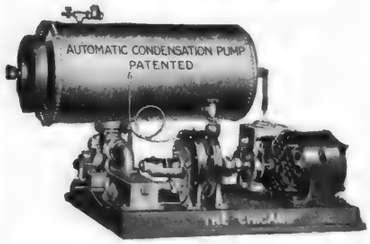
Quiet and efficient in operation.

Outfits furnished for 1,000 to 10,000 sq. ft. radiation and for 10 and 20 lbs. pressure.

Write for full particulars

THOMPSON MFG. CO.
Des Moines . . Iowa

The "CHICAGO"—It's Different



No Float—The Tank Tilts
Simple and Sure
as the Law of Gravity
Any Capacity—Any Pressure
Quick Delivery

HEATING INSURANCE—The "Old Line" Variety

The kind we write when we sell you a CONDENSATION PUMP AND RECEIVER.
The perfected product of an "Old Line" Company—pioneer builders of these units.
Insures Efficiency in the heating system—makes a poor plant good, a good plant better.
Insures Satisfaction to the user—so simple and positive in action, literally "grief proof."
Insures Profit to you—every satisfied customer is a standing advertisement.

Ask for our new Catalog. It tells all about our other products—

Bilge Pumps, Sewage Ejectors, Turbine House Pumps,
Hot and Cold Water Circulating Pumps

CHICAGO PUMP CO., 2325 Wolfram St., Chicago, Ill.

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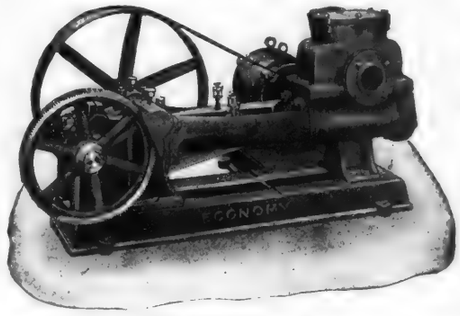

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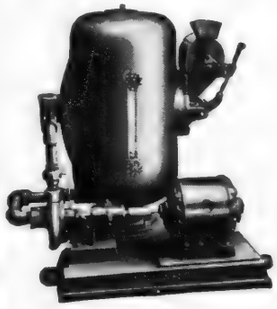

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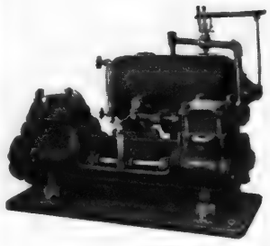

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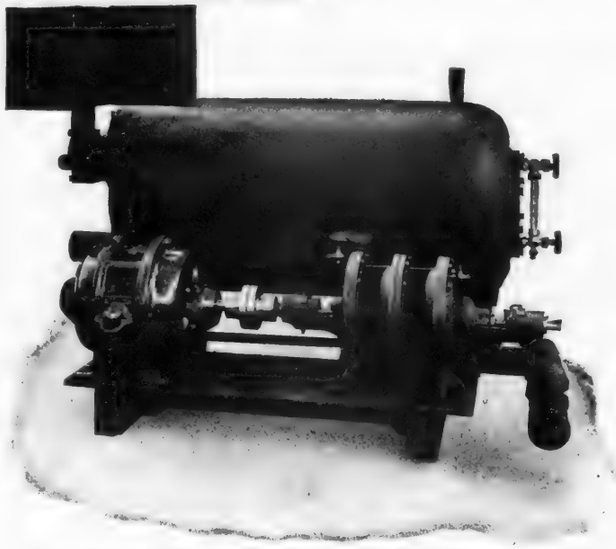

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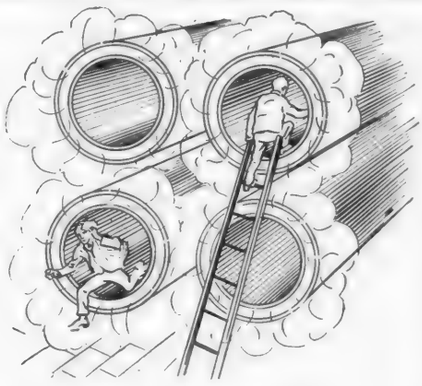

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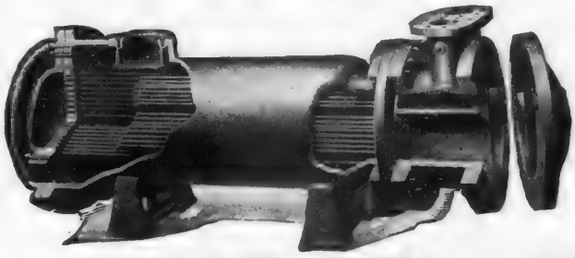

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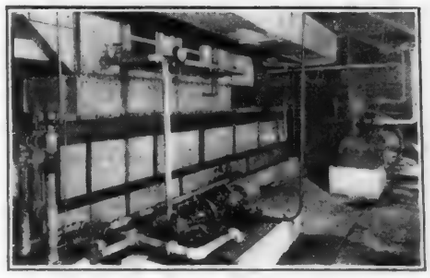

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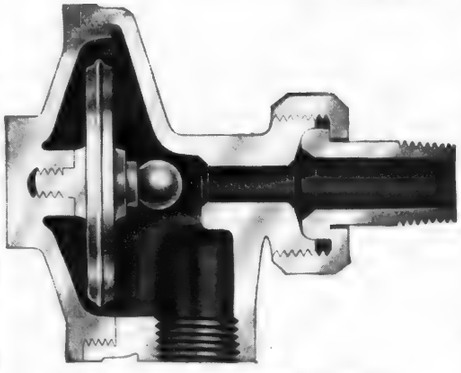

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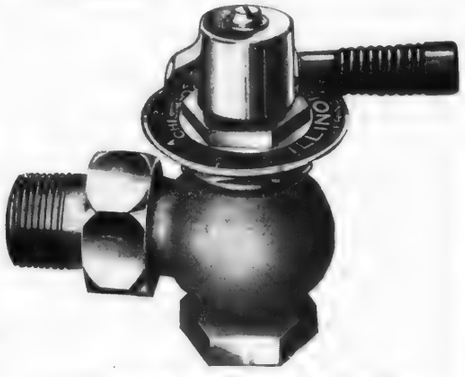

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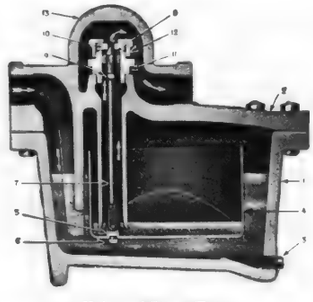

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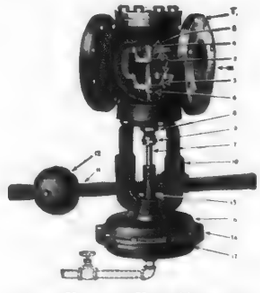

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VOL. XVIII. NO. 3

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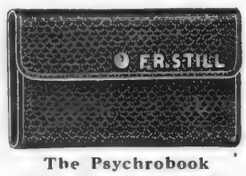

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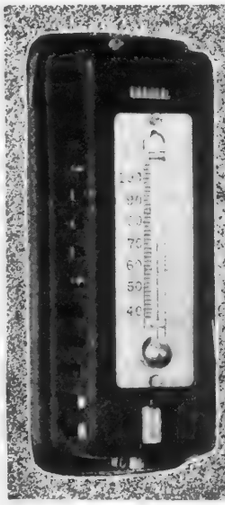

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THE RELATION BETWEEN KATATHERMOMETER AND THERMOMETER READINGS UNDER ORDINARY INDOOR CONDITIONS

By C. E. A. WINSLOW
Professor of Public Health, Yale School of Medicine
and E. L. HEWITT

STUDENTS of ventilation have been deeply interested during the past five years in the possible value of the katathermometer as a measure of the comfortableness of atmospheric conditions. This instrument was devised by Dr. Leonard Hill and has been described by him and by his associates in a number of important communications. (1) As now supplied by the Liebe-Gorman Company of Chicago, the katathermometer consists of a specially-designed thermometer with large bulb, the stem graduated from 95° to 100° F. The instruments are generally used in pairs, one with a dry and the other with a wet bulb, and are heated to somewhat over 100° and then allowed to cool. the time taken to fall from 100° to 95° being recorded by a stop watch. The values obtained will, of course, be controlled, not only by the atmospheric temperature, but also by the extent of air movement (and, in the case of the wet bulb, by the atmospheric humidity); and it is in the fact that this instrument takes into account the air movement which affects bodily comfort to such an important degree that its special value exists.

The rate of fall of a particular katathermometer under given atmospheric conditions will obviously depend upon the relative capacity of bulb and stem, the thickness of the glass, the surface area of the bulb, etc., and in order to obtain results of absolute value it is necessary to use a conversion factor which shall give us the actual rate of heat loss in millicalories per square centimeter per second. To determine the actual constants for each instrument, under various conditions of temperature and air movement, would, of course, be a serious task. Hill has recommended the use of a simple conversion factor based on the determination of the rate of fall of a given instrument, determined in a calorimeter at a single temperature with no air movement. This has been the procedure used by us, although we doubt very much whether the results obtained are really applicable to other temperatures and to various conditions of air movement.

SENSATIONS OF COMFORT CORRESPOND CLOSELY WITH KATATHERMOMETER READINGS.

The value of the katathermometer is in discriminating between the comfortableness of air conditions where marked differences in air movement exist. Thus it has been shown by one of us in an earlier communication (2) that under outdoor conditions, or indoors with circulating fans in operation, sensations of comfort, as indicated by the votes of a group of observers, corresponded closely with katathermometer readings, but often failed entirely to correspond with temperature readings. For example, we may contrast two observations taken, respectively, out-of-doors in a strong breeze and indoors before a fire. The temperature in both instances was 72° F.; but outdoors the katathermometer time was 115 seconds and the observers were too cool, while indoors the katathermometer time was 277 seconds and the observers were too warm. Outdoor conditions, with temperatures of 75°-79°, were more comfortable and showed lower katathermometer readings than this room with a fire at 72°. Similar relations were indicated by a series of indoor observations in hot summer weather made first without, and then with, exposure to the direct draft from an electric fan. When the fan was turned on the thermometer reading, of course, remained substantially unchanged, but the katathermometer readings and the comfort votes changed enormously. On six different days, with ordinary thermometer readings varying from 69° to 79° F. the comfort vote showed uncomfortably warm conditions and the katathermometer dry-bulb took 170 seconds or more to fall; while with the fan the atmosphere felt too cool and the katathermometer readings were under 120 seconds. (3) With the fan in operation, a temperature of 87° was as comfortable, and showed about the same katathermometer reading as a temperature of 72° without the fan.

RECENT TESTS IN LARGE FACTORY.

In a study recently conducted by us—which has included nearly 2000 observations of wet and dry-bulb temperature and katathermometer readings in the various workrooms of a large factory during the period July-November, 1920,—we have been again convinced of the value of the katathermometer in detecting differences of comfort due to variations in air movement. Variations in atmospheric conditions between different workrooms, sufficient to influence not only comfort but even health (as evidenced by mor-

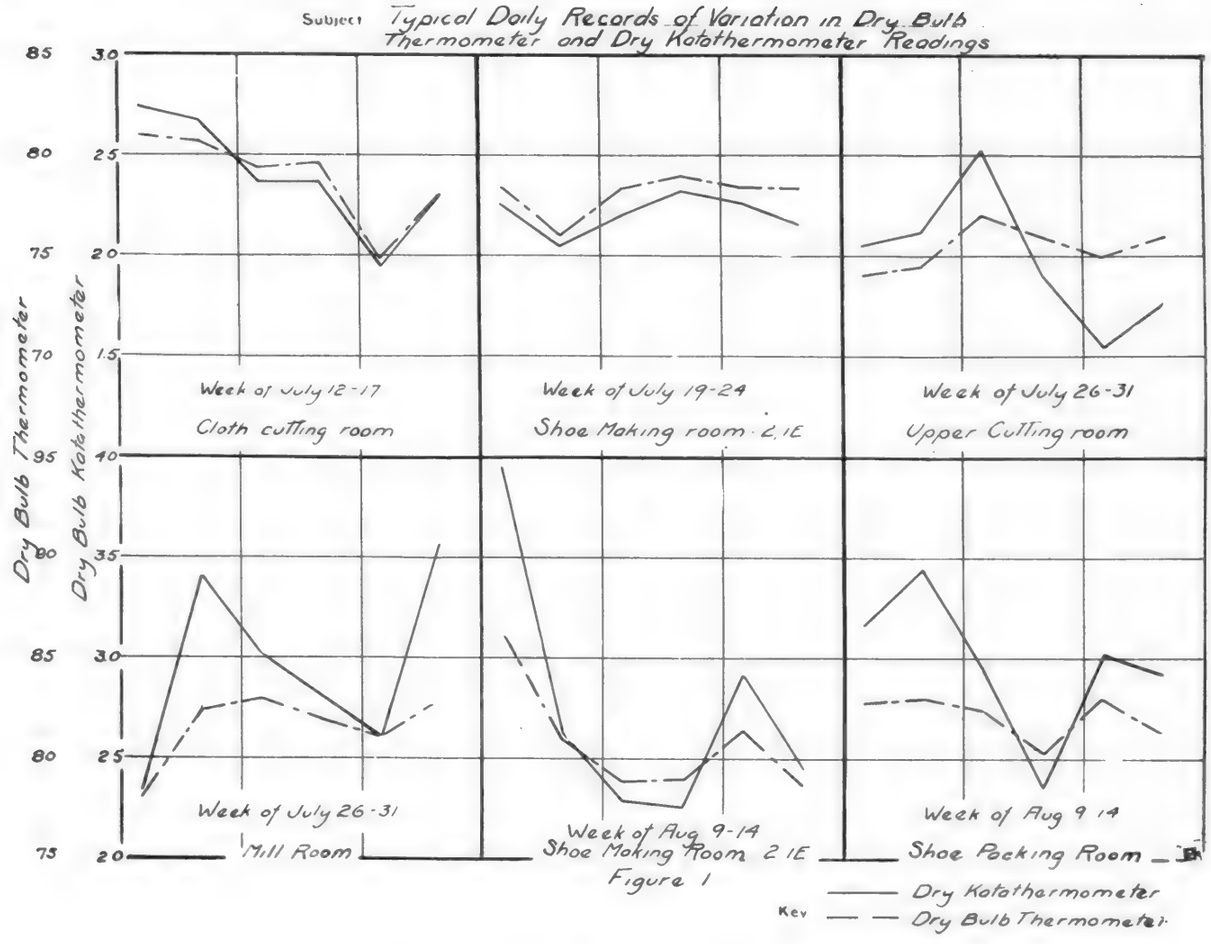


Figure 1

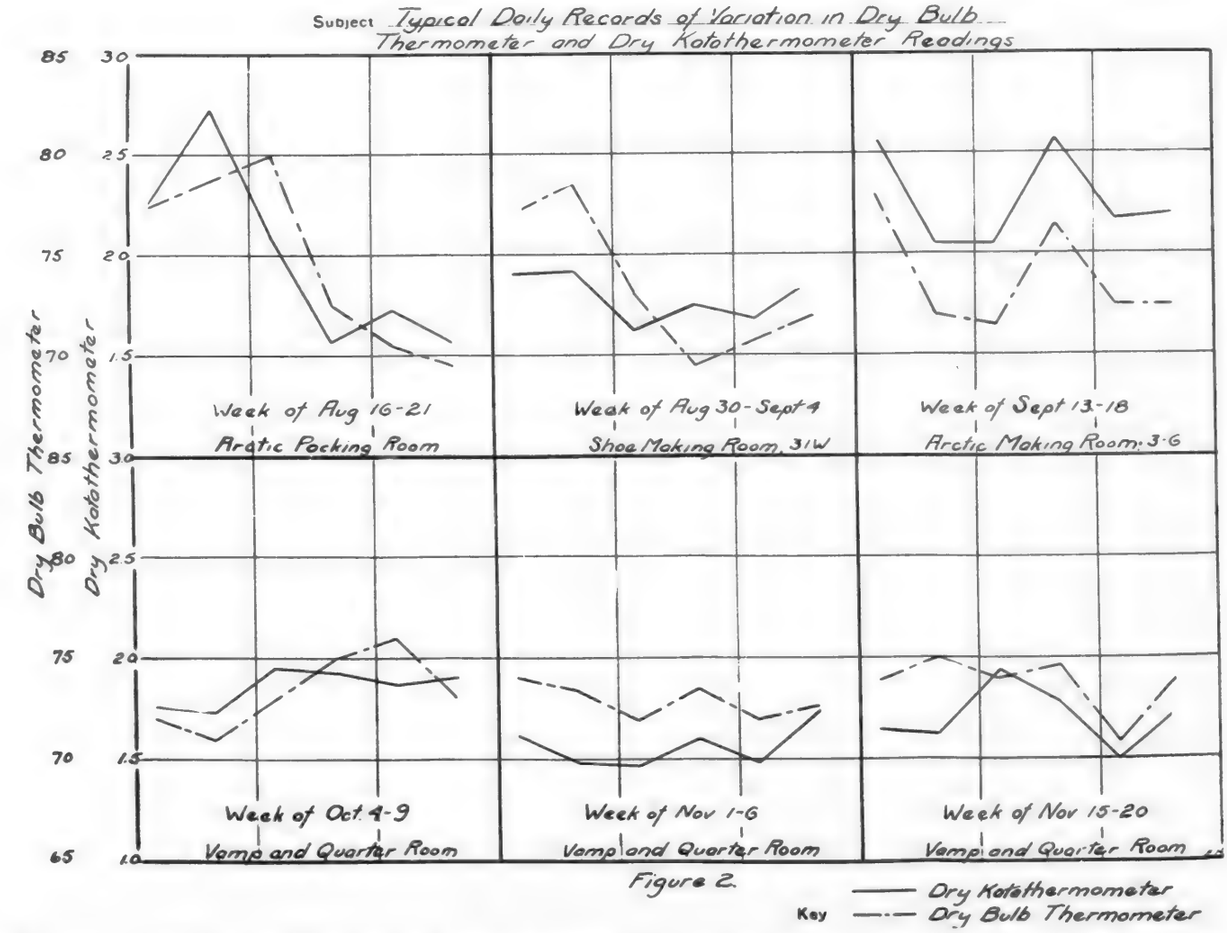


Figure 2.

FIGS. 1 AND 2—TWELVE SETS OF DRY-BULB THERMOMETERAND DRY-BULB KATATHERMOMETER CURVES SHOWING THAT UNDER ORDINARY CONDITIONS IN A GIVENWORKROOM THE ORDINARY THERMOMETER READINGS ARE SUFFICIENT.

ıbidity statistics) were clearly revealed in certain instances by katathermometer readings, but were not indicated by records of ordinary temperature.

On the other hand, we have been equally impressed by the fact that under the ordinary average conditions of the factory workroom variation in air movement is a comparatively unimportant factor and the relation between katathermometer and temperature readings is, therefore, often a fairly constant one for a given workroom. In Figs. 1 and 2, for example, are presented twelve sets of dry-bulb temperature and dry-bulb katathermometer curves (1) taken at random from our records, each of the twelve curves showing the daily variations during a period of a week in a given workroom. It will be noted that the parallelism between the two curves is in each case a very close one and it would seem clear that for the purpose of studying daily variations in a given workroom the ordinary thermometer gives all the information we need.

KATATHERMOMETER READING CORRESPONDING TO COMFORTABLE TEMPERATURE.

It seems particularly important, if the readings of katathermometer and the ordinary thermometer are to be used in some degree interchangeably that we should determine with some exactness the katathermometer reading corresponding to a comfortable temperature under ordinary indoor conditions where air movement plays an unimportant part. The comparison with comfort votes previously cited (2) indicated that a drop from 100° to 90° in 150 seconds on the dry katathermometer corresponded to comfortable conditions, and studies made by L. Greenburg with the original instruments used in the earlier study show that this rate of fall would be approximately equivalent to a heat loss from the dry katathermometer of 6.2 millicalories per square centimeter per second during the 100°-95° interval.

In order to bring out this relation more clearly we have converted the records obtained by the use of the dry katathermometer in the present study into millicalories of heat loss per square centimeter of surface per second, the procedure which makes possible a comparison of various individual instruments of this type. We have then calculated, in Table I, the average heat loss from the dry katathermometer recorded for each month for each degree of dry-bulb temperature and have plotted the results in Fig. 3. It is evident that above 66°, at least, there is a very close inverse correlation, the rate of heat loss increasing as the temperature falls. Below 66° the rate of heat loss appears to increase more rapidly but this may well be due to the fact that the observations are few below this point. The comfortable temperature of 68° seems to correspond, on the average, to a heat loss from the dry katathermometer of about 6.1 millicalories, which almost exactly checks the value previously derived by one of us from a study of outdoor and indoor conditions as compared with the votes of a group of observers as to bodily comfort.

The wet-bulb katathermometer reading ought theoretically to be the ideal measure of atmospheric comfort, since it brings in the factor of humidity, in addition to temperature and air movement. Hill and his associates have suggested a heat loss of 20-30 millicalories per square centimeter per

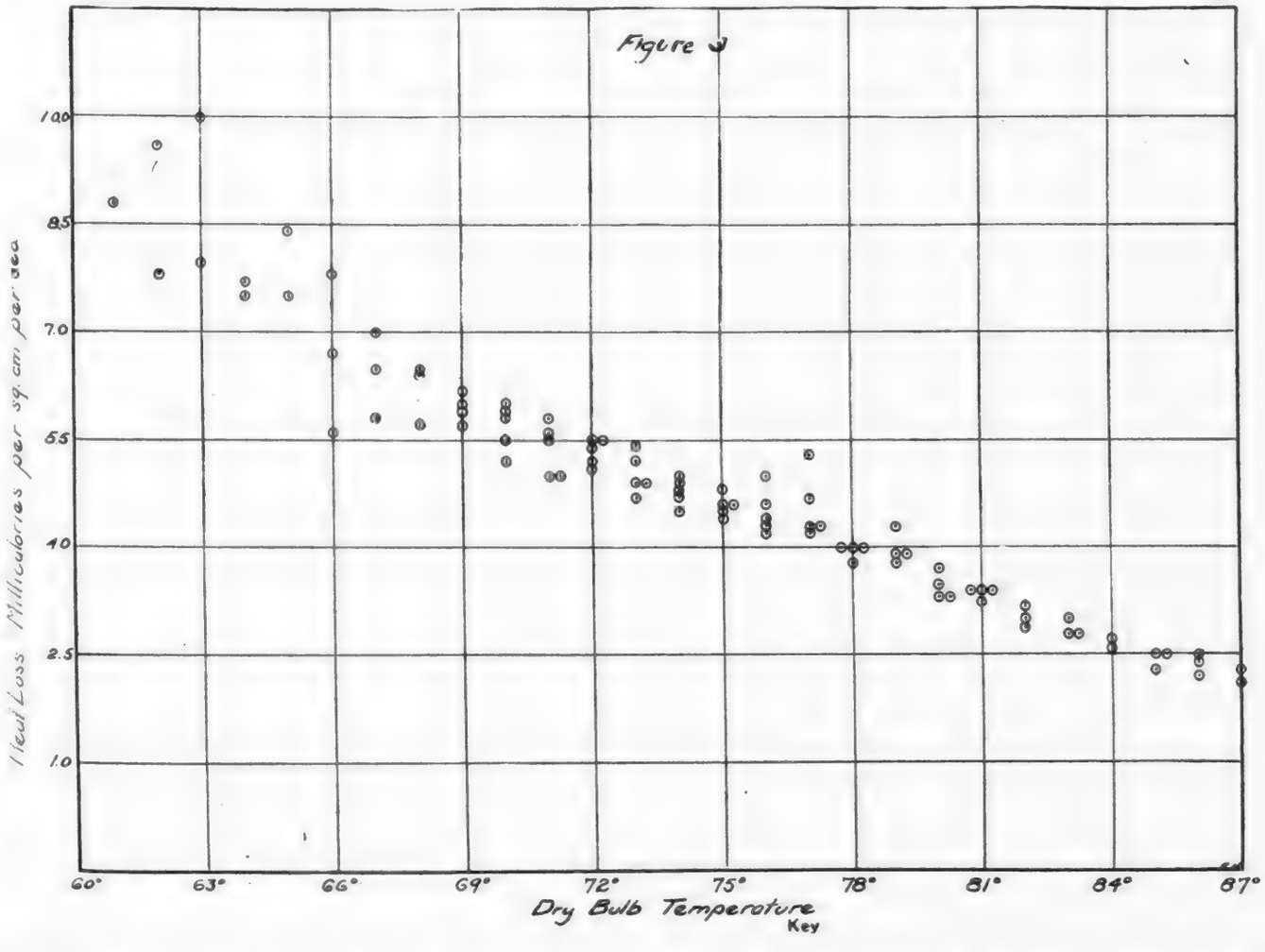


FIG 3—AVERAGE HEAT LOSSES FROM THE DRY KATATHERMOMETER FOR EACH DEGREE OF DRY-BULB TEMPERATURE.

Subject Typical Daily Records of Variation in Wet Bulb Thermometer and Wet Katathermometer Readings - Weeks with no marked temperature changes

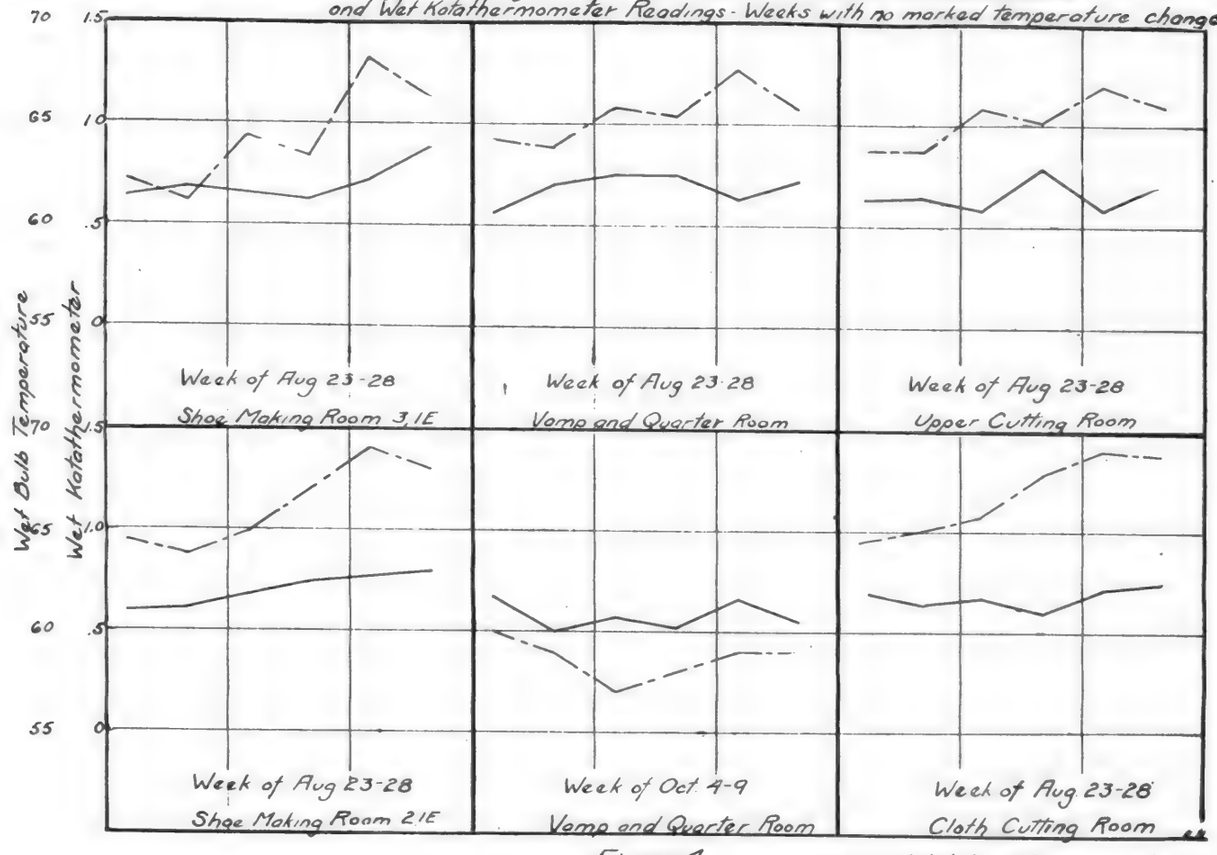


Figure 4

Key —— Wet Katathermometer
—·— Wet Bulb Thermometer

Subject Typical Daily Records of Variation in Wet Bulb Thermometer and Wet Katathermometer Readings. Weeks with marked temperature changes

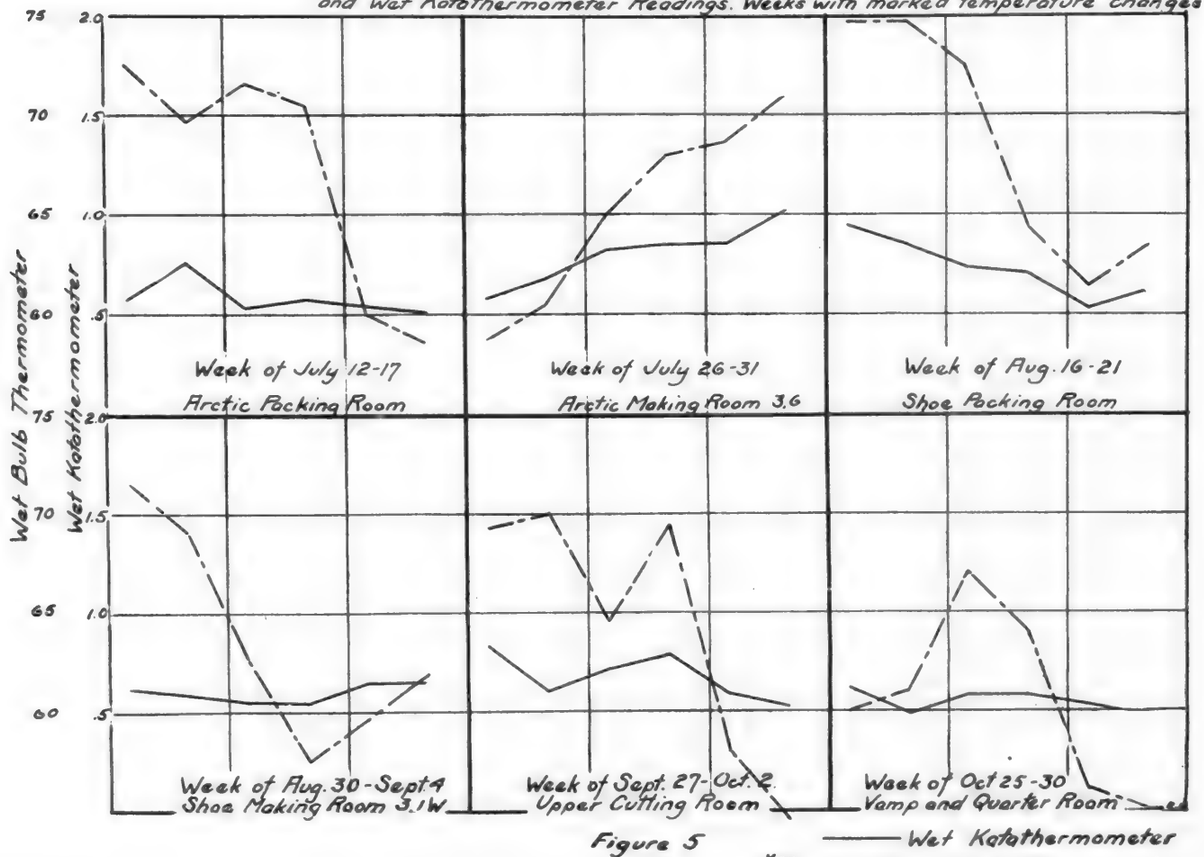


Figure 5

Key —— Wet Katathermometer
—·— Wet Bulb Thermometer

second from the wet-bulb katathermometer as corresponding to the conditions of comfort.

We find in our study that just as the dry-bulb temperature and dry katathermometer reading correspond under ordinary indoor conditions, so does the wet katathermometer reading bear a similarly close relation to the wet-bulb temperature, except that it is somewhat less sensitive to temperature differences. Fig. 4 shows a typical series of curves for various workrooms in weeks when the temperature did not vary widely. Here the wet katathermometer readings follow the wet-bulb temperature readings. Fig. 5 shows a similar series of curves for weeks which showed wider variations in temperature; and in such weeks the two curves diverge more widely,—the wet-bulb temperature responding much more readily to the variations which occur from day to day.

rate of fall and a consequently wider range within which significant variations may occur. This could be easily effected, of course, by reducing the size of the bulb of the instrument to be used as a wet-bulb katathermometer.

TEST RESULTS CONFIRM HILL'S STANDARD.

So far as our results go they tend to confirm Hill's standard of 20 millicalories lost per square centimeter per second from the wet-bulb katathermometer as an upper limit of rate of heat loss for comfort. This rate was equivalent to a time period of about 0.45 minute on our instruments, a time which was exceeded in 90-95% of our observations, just as the comfortable limits of 6 millicalories on the dry-bulb thermometer and of 68° on the thermometer were exceeded in over 90% of our observations.

Table I.—Heat Losses from Dry Katathermometer. For Each Month—For Each Degree of Dry-Bulb Temperature. (In Millicalories per square centimeter of surface per second.)

Dry-Bulb Temperature. Deg. F.

	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Total Millicalories																														
July										104	386	752	766	939	1519	1779	2282	2969	1966	1342	1170	1071	563	469	75	124	115		54	
Aug.									227	407	601	1022	1212	1299	1445	1429	1277	1254	1952	1304	954	696	455	349	202	213	146	18		32
Sept.						225	525	569	1768	2460	2559	2756	2993	3287	2568	1951	1222	644	355	300	343	173	85	104	73	23				
Oct.		96	100	231	589	1476	2083	2815	3513	4382	4390	3228	2007	1860	1115	925	312	384	171	66	102									
Nov.	88	157	160	302	677	667	2041	1699	3046	4664	3586	3578	2278	1398	625	496	106													
Number of Observations.																														
July										2	7	14	16	19	33	39	53	75	50	36	34	34	19	18	3	5	5		2	
Aug.									4	7	12	20	25	29	33	34	30	31	51	37	28	23	16	13	8	9	7	1		2
Sept.						4	9	10	30	45	51	53	61	70	57	45	29	16	9	9	10	6	3	4	3	1				
Oct.		1	1	3	7	19	32	44	57	74	76	60	38	37	24	22	7	10	4	2	3									
Nov.	1	2	2	4	9	10	29	26	51	79	64	65	44	29	13	10	2													
Average millicalories.																														
July										5.2	5.5	5.4	4.8	4.9	4.6	4.6	4.3	4.0	3.9	3.7	3.4	3.2	3.0	2.6	2.5	2.5	2.3		2.7	
Aug.									5.7	5.8	5.0	5.1	4.9	4.5	4.4	4.2	4.3	4.0	3.8	3.5	3.4	3.0	2.8	2.7	2.5	2.4	2.1	1.8		1.
Sept.							5.6	5.8	5.7	5.9	5.5	5.0	5.2	4.9	4.7	4.5	4.3	4.2	4.0	3.9	3.3	3.4	2.9	2.8	2.6	2.4	2.3			
Oct.		9.6	10.0	7.7	8.4	7.8	6.5	6.4	6.2	5.9	5.8	5.4	5.3	5.0	4.6	4.2	4.5	3.8	4.3	3.3	3.4								6
Nov.	8.8	7.8	8.0	7.5	7.5	6.7	7.0	6.5	6.0	5.9	5.6	5.5	5.2	4.8	4.8	5.0	5.3													

LIMITATIONS OF WET-BULB KATATHERMOMETER.

The great difficulty with the wet-bulb katathermometer lies in the fact that the instrument as constructed falls so rapidly under almost all ordinary conditions that there is very little range for significant variations. Table II shows the distribution of individual wet katathermometer readings actually obtained by us during the warmest and coolest months of our study.

TABLE II.—VARIATIONS IN INDIVIDUAL KATATHERMOMETER READINGS.

	Number of observations	Time of Fall, in Minutes: Under 0.40	0.40-0.49	0.50-0.59	0.60-0.69	0.70-0.79	Over 0.79
		Per Cent. in Each Group					
July	462	0.4	4.6	19.1	36.6	28.6	10.8
Nov.	457	1.5	18.0	49.1	27.4	4.2	

It will be noted that in July 84% of all the observations taken fell between 0.50 and 0.79 minutes; in November 94% fell between 0.40 and 0.69 minutes; while the time interval, 0.50-0.69 minutes included 55% of the July and 76% of the November records. Two-tenths of a minute is a somewhat narrow range to include so large proportion of the data obtained and we are inclined to believe that the wet-bulb katathermometer will be of little practical value until its construction is so modified as to give a slower

CONCLUSIONS.

In conclusion it may be stated that:

1. The dry-bulb katathermometer is of great value in determining the comfortableness of air conditions where air movement enters as an important factor, as is the case outdoors or indoors in the presence of air currents produced by ventilating fans.

2. Under ordinary indoor conditions, where no powerful system of ventilation is in operation, variations in katathermometer readings parallel closely variations in temperature and the use of the more elaborate instrument is unnecessary.

3. The wet-bulb katathermometer is of little practical value on account of the fact that its range is so small as to make the recording of slight variations on each side of the comfort zone exceedingly difficult.

4. The limit of ordinary comfort corresponds quite closely to a heat loss of 6 millicalories per square centimeter per second from the dry katathermometer and less closely to a heat loss of 20 millicalories per square centimeter per second from the wet-bulb katathermometer.

(1) Hill, L.; Lancet, 1913, 184, 1283.
Griffith, O. W. The Medical Officer, 1915, 13, 273.
Hill, L., Griffith, O. W., Flack, M. Trans. Roy. Soc., B, 1916, 207, 183.
Hill, L. The Science of Ventilation and Open Air Treatment. Medical Research Committee, Part I, 1919, Part II, 1920.
(2) Winslow, C.-E. A. Science, N. S., 1916, 43, 716.
(3) The figures cited for katathermometer times are in seconds and correspond to a 10 deg. drop (100 deg.-90 deg.) which was the interval used in the older instruments.
(4) The katathermometer values are in minutes and decimals thereof and correspond to the drop from 100 deg. to 95 deg.
(5) Winslow, C.-E. A. Science, N. S., 1916, 43, 716.

CHARACTERISTICS OF 85% MAGNESIA AS A NON-HEAT-CONDUCTING COVERING

Results of Recent Tests, with Curves Showing the Most Economical Thickness of Pipe Covering for Different Conditions

By EDWARD R. WEIDLEIN

Associate Director of the Mellon Institute of Industrial Research, University of Pittsburgh.

(*Concluded from February issue*)

A CAREFUL study of the technical and theoretical sides of any problem is essential in order to determine the economic value of the process or product, and so with "85% magnesia" covering the result desired is the maximum net saving of money for any given condition. If the covering cost were nothing, the proper thickness would be limited only by the requirements of space available, for each increased thickness would result in some slight increased saving in heat. In a practical case where the covering has a definite cost, a point is reached where the increased cost of the covering will be greater than the additional saving in heat effected. It is this point in which the user of coverings is most interested, for it defines the maximum net saving to be accomplished.

PRICES OF COVERINGS VARY WITH THICKNESS.

One important factor to take into consideration is the fact that prices of coverings vary with the thickness. For flat surfaces the price is directly proportional to the thickness, starting at 30c per square foot for coverings 1 in. thick. The difficulties encountered in the manufacture of molded coverings for pipes result in an increased cost per square foot for a 1-in. thickness, and the cost increases much more rapidly with the thickness than in the case of flat surfaces. More material is also required in molded coverings per square foot of pipe surface than in the same thickness in flat blocks on account of the curvature of the surface.

The cost per square foot of surface covered can be determined for any thickness desired. From this cost the annual fixed charges due to the covering can be calculated. After considerable investigation, it has been determined that 20% of the list price of the covering would be a fair allowance for the cost of application, and 13% of the total cost as the annual charges (6% interest, 5% depreciation and 2% insurance and miscellaneous). This fixed charge has been calculated for seven different sizes of pipes and five different thicknesses, based on the manufacturers' list costs of coverings.

TABLE I.—MONTHLY SAVING, IN DOLLARS AND CENTS, BY THE USE OF "85 PER CENT MAGNESIA" PIPE COVERING.

Standard thickness, per 100 lineal feet of steam-pipe.

Size of Pipe In. Diam.	5 lbs. Steam Pressure	10 lbs. Steam Pressure	50 lbs. Steam Pressure	100 lbs. Steam Pressure	150 lbs. Steam Pressure	200 lbs. Steam Pressure	200 lbs Steam Pressure 100 deg. superheat
1/2	$1.44	$1.58	$2.20	$3.28	$3.66	$4.11	$6.80
3/4	1.72	1.89	2.87	3.70	4.26	4.89	8.03
1	2.11	2.30	3.56	4.80	5.35	6.04	10.00
1–1/4	2.52	2.74	4.22	5.52	6.50	7.25	12.20
1–1/2	2.86	3.10	4.73	6.14	7.29	8.17	13.70
2	3.53	3.74	5.86	7.63	8.93	10.11	16.80
2–1/2	4.25	4.39	6.95	9.17	10.55	11.90	19.90
3	5.00	5.33	8.30	10.90	12.60	14.30	23.82
3–1/2	5.72	6.22	9.60	12.40	14.40	16.32	27.23
4	6.50	7.06	10.60	14.05	16.40	18.40	30.85
4–1/2	7.30	7.69	11.80	15.35	17.92	20.25	34.00
5	7.97	8.64	13.16	17.20	20.00	22.72	38.00
6	9.36	10.15	15.60	20.38	23.82	26.88	44.90
7	10.90	11.70	18.38	23.68	27.60	30.80	52.00
8	12.26	13.22	20.40	26.60	21.20	34.90	58.55
9	13.80	14.70	22.70	29.00	34.52	38.61	64.80
10	15.08	16.33	25.00	32.70	38.40	43. 8	72.40
100 sq. ft. 1–1/4 in. thick Flat surface	5.26	5.67	8.80	11.50	13.48	15.12	25.44

VALUE OF HEAT LOSSES THROUGH DIFFERENT THICKNESSES OF COVERING.

The other cost to be charged to the operating expenses of the covering is the value of the heat losses through the different thicknesses of coverings. The previous work done on measuring the loss through a large number of samples of magnesia furnished the necessary data for calculating the loss in heat units. After the heat loss was determined, it was necessary to convert the loss into dollars and cents. The assumptions used in making this conversion were that 1 lb. of coal as burned will evaporate 7 lb. of water from and at 212° F., and that each pound of steam contains 1000 B. T. U. above the feed-water temperature. The value of the heat losses was calculated for seven sizes of pipes, five temperature differences between pipe and air, and four different costs of heat, both on the basis of a known cost per million B. T. U. and on a cost per ton of coal and the average conditions of steam generation given above. By making these calculations both ways, the results are applicable to plants where the steam costs are accurately known, as well as to those where accurate records are not kept.

SELECTING MOST ECONOMICAL THICKNESS.

By combining the fixed costs and the heat losses per square foot per year, the total operating expenses were obtained. Once these are known, it is simply a matter of selecting that thickness which gives the minimum annual operating expense to obtain the proper covering to use. It is evident that the thickness which gives the minimum

TABLE II.—COAL SAVED BY "85 PER CENT MAGNESIA" COVERING 1-IN. THICK.

	STEAM PRESSURE						
	Saturated 5 lbs.	Saturated 10 lbs.	Saturated 50 lbs.	Saturated 100 lbs.	Saturated 150 lbs.	Saturated 200 lbs.	200 lbs. with 100 deg. superheat
Steam Temp. Deg.	228	240	298	338	366	388	488
B. T. U. *loss* per hr. sq. ft. bare pipe	367	409	625	802	937	1058	1735
B. T. U. *loss* per hr. sq. ft. of pipe covered with "85 per cent magnesia"	69	76	105	126	142	153	210
B. T. U. *saved* per sq. ft. by covering pipe with "85 per cent Magnesia"	298	333	510	676	795	905	1525
Tons (2240 lbs.) coal *saved* per 10,000 sq. ft. per year of 8,760 hrs. by pipe covered with "85 per cent Magnesia"	1190	1330	2080	2700	3180	3620	5650
Cars of coal *saved* year, as above, at 40 tons per car	30	36	52	68	80	90	140

operating expense also gives the maximum net saving, as the loss from bare pipe is a constant under given conditions and the net saving is the difference between the operating expense and the loss from bare pipe. The curves in Fig. 12 are for use in plants where heat costs, steam-temperatures, etc., are accurately known. They are applicable to all heated surfaces since they are based on the temperature of the surface and the value of the heat in dollars per million B. T. U.

SAVINGS POSSIBLE.

The savings accomplished by the use of the economic thickness of pipe covering is comparatively very great. The use of "85% magnesia" of suitable thickness will result in a saving which will repay the orignal cost of the installation in less than a year in practically every case, and under constant operation at high temperatures where great thicknesses are called for the saving will often pay for the installation in as short a time as two months.

Table I shows the actual cost saving per month with $5.00 coal by the use of "85% magnesia" pipe covering. Table II shows in greater detail the serious losses which are going on in many plants today—losses which are wholly preventable but which amount in the aggregate to many tons of coal yearly.

RESULTS OF TYPICAL TESTS.

In order that the results of the laboratory tests might be checked on a larger scale, several practical tests were made. The first and most important of these was a boiler test made at a mine in Bruceton, Pa. There were two boilers in the plant, of 80 and 60 horse-power, locomotive

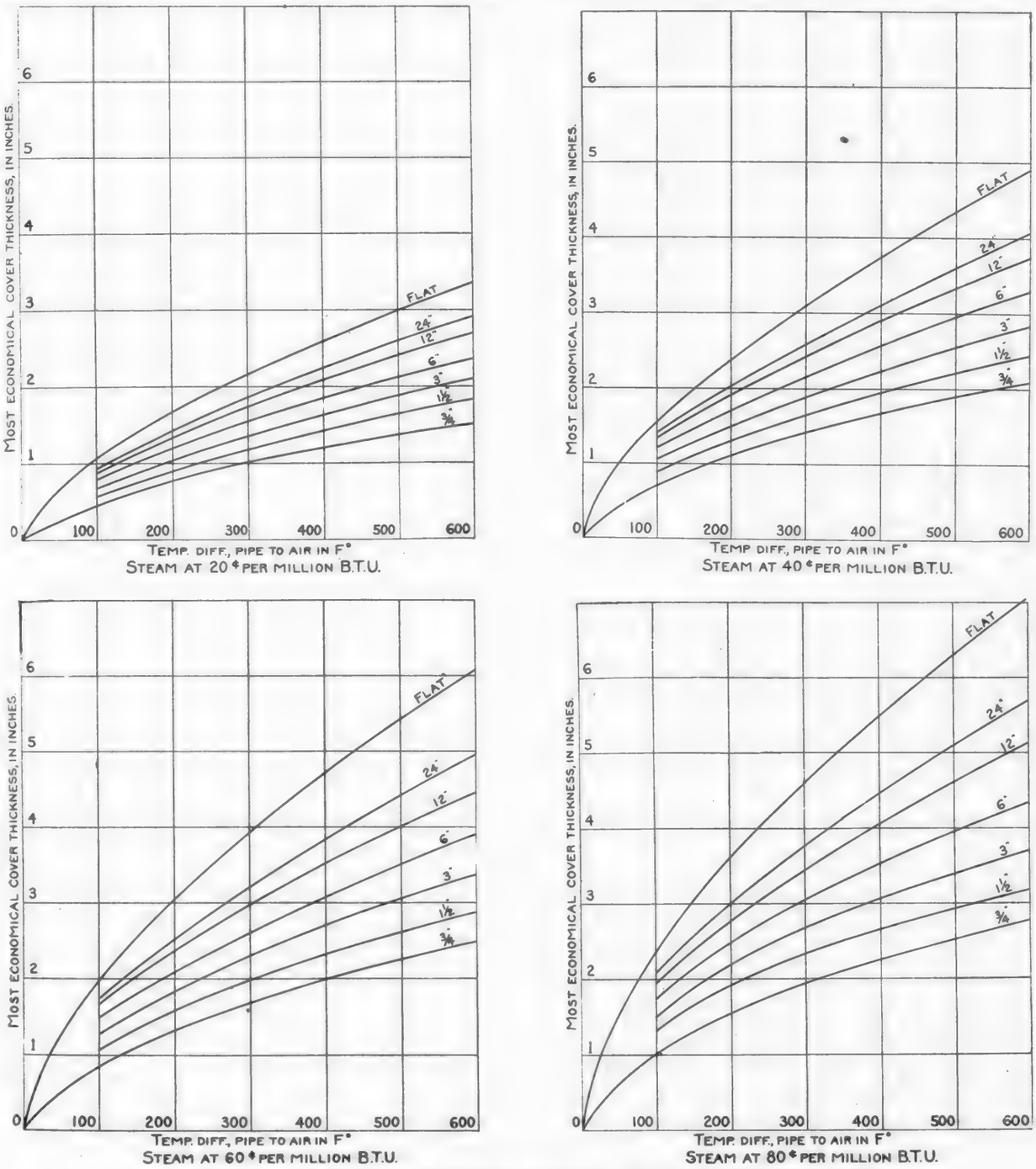


FIG. 17—THICKNESS OF MAGNESIA COVERING FOR MAXIMUM NET SAVING.

type. The total exposed surfaces on these boilers amounted to 675 sq. ft. The tests covered a period of 24 hours. Conditions of load, etc., were practically the same during both tests. During the first test, while the boilers were uncovered, 10,784 lbs. of coal were burned to evaporate 58,000 lbs. of water. In the second test, after the boilers had been covered with 2 in. of "85% magnesia" block and plastic, 9296 lbs. of coal were burned to evaporate 59,500 lbs. of water. The evaporation rate during the first test was 6.35 lbs. of water from and at 212° F. per pound of coal as fired, and during the second 7.55 lbs.; 1500 lbs. more water were evaporated with 1488 lbs. less of coal burned. If calculated for an equal evaporation of water, the saving in coal would be 1700 lbs. per day. The calculated saving based on the laboratory experiments was between 1400 and 1500 lbs. per day. This saving amounts to 15% of the coal burned due to covering the boiler alone, as the pipe lines were not included in the test.

FUNCTIONS OF THE ORIFICE IN STEAM AND HOT WATER HEATING

PART III.

Application of the Fixed Orifice to Water Heating Systems.

BY S. HOMER WOODBRIDGE.

CIRCULATION of water through the "boiler," piping and radiators of a gravity water heating system is caused by the difference in weight of two equal columns of water at unequal temperatures, the cooler and heavier column falling and pushing the lighter column upward. The difference in weights may be expressed in terms of the heights of equal weights of water at unequal temperatures confined in vertical pipes of equal size.

Let two vertical pipes of the same size be filled to an equal level of 100 ft. with water at 100° F. and let one of the bodies of water be then raised to a temperature of 200°. The height of the 200° water column (expansion of the container neglected) will then be 3.05 ft. greater than that of the cooler column, or 3.05% for 100° difference of temperature. That difference in height is commonly called the motile "head," due to which flow takes place through the open ways of a connected water heating system.

A "head" so computed is, however, approximate only. The true "head" is that obtained as when one of the above columns having a temperature of 100° and the other of equal height a temperature of 200° are then both brought to the same temperature of say, 100°. The difference in heights would then be 2.96 ft. That value of 2.96% is so nearly that of the 3.05% above obtained, that the latter and more easily computed "head" is the one generally employed by engineers in planning the piping of water gravity heating systems, and is that which is used in the present study.

EXPLANATION OF "GRADE" OR "GRADIENT."

The "head" divided by the length of piping of the system through which water is made to flow because of it is termed the "grade," or "gradient," just as a slope of 1 ft. in 20 ft. of road-way is spoken of as grade 1/20. Thus, if—in Fig. 7, A—at one end of a horizontal pipe 100 ft. long there be attached a vertical pipe 1 ft. high, and the whole piping be filled with water, flow will take place through the open pipe way under the action of the "head" C-A. Manifestly the gradient of the system must hold the same for any and all points along the pipe A-B as E or G for the reason that the ratios of verticals to horizontals remain constant, whatever point in the horizontal is considered.

Again, if reference be made to Fig. 7, B, in which the lines A-I and B-J represent vertical pipes, each 50 ft. in length, and cross connection at the bottom and top, and water filled to level A-B; let the column A-I have a temperature 100°, and B-J 200°. The approximate hydraulic "head" resulting from that inequality in temperature will be 1.5 ft. and the gradient (exclusive of connection), will become $1.5/100 = 1/67$.

Here again the gradient remains the same, as also the flow rate, whatever the heights considered, because the ratios between "heads" and lengths vary in the same proportion, and the gradient remains constant whatever the length of the pipe be made.

Therefore, and contrary to the common conception, if radiators of equal size and exposure, all fed with water at the same temperature, and discharging water at the same temperature, and located at any different heights above the source of heat, and connected by flow and return pipes all of the same size, the flow rate through the first floor radiator would be the same as that on the fourth, or the tenth, or the twentieth, in-so-far as frictional effects affect flow.

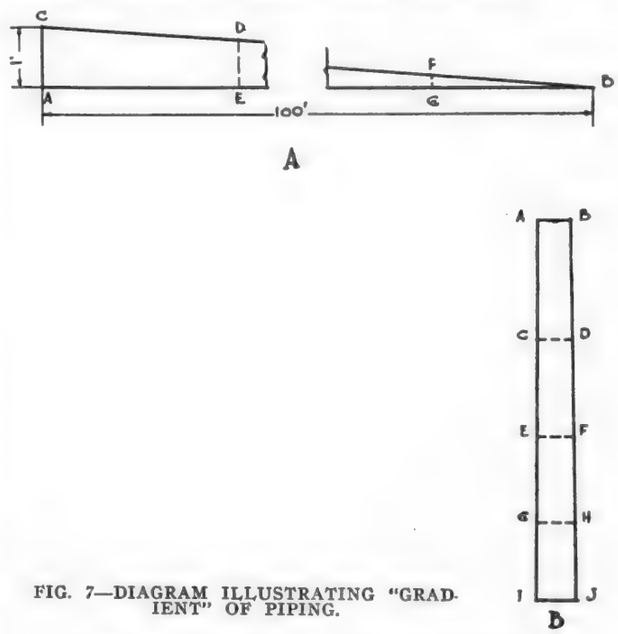


FIG. 7—DIAGRAM ILLUSTRATING "GRADIENT" OF PIPING.

PRACTICAL PROBLEMS IN WATER CIRCULATION.

Practical problems in water circulation through heating systems involve other factors than those of vertical lengths of flow and return piping, namely the lengths of horizontal runs of feed and return mains, and those of "heads" required for giving initial motion to water on entering pipe-

NOTE—The efficiency of the orifice in preventing air binding in the case of the pipe heater, described in the preceding paper as exceptional, was minimized by giving the length of the pipes at 42 in., rather than 42 ft., as was the actual case. (See page 33 January issue, second column, line 1.)

ways from the "boiler" and from radiators. Because the "head" expended in producing such initial motion, on entering pipes, wihout contraction of vein, is equal to that expended in overcoming frictional resistance to flow through a length of the same pipe equal to 53 diameters of that pipe, the head for "vis-viva" may be, and is in this discussion, regarded as negligible. The entire "head" resulting from the difference of temperature in equal vertical columns of water may, therefore, be regarded as available for water propulsion through the entire circuit of piping from and return to the heat source, and the "heads," divided by the entire lengths of the circuit, give the gradients for the radiators corresponding to their several heights.

A TYPICAL EXAMPLE.

Let there be eight radiators on as many successive floors, each of size to yield 10,200 B. T. U. per hour from 3.4 cu. ft. of water when the drop in temperature of the water in passing through the radiators is from 200° to final 150°, the size of such radiators being 60 sq. ft. each. Since the "heads," and consequently the gradients, decrease from the uppermost to the lowermost radiator, it would be possible to secure equality of flow throughout the series by exactly proportioning the sizes of pipes to the motile value of the several gradients. To make evident the impossibility of effecting such proportioning by use of stock sizes of pipes, the following problem involving the eight radiators is presented.

For the purpose of simplifying the problem, let each radiator be separately connected with the "boiler" by its own loop of piping, and let the system be one of over head supply and basement return, giving to all radiators the same lengths of pipe circuit. Let the successive heights of the radiators above the heat source be 9 ft.; 21 ft.; 33 ft.; 45 ft.; 57 ft.; 69 ft.; 81 ft.; 93 ft.; and let the total lengths of each of the several horizontal and vertical runs be 436 ft.

In the accompanying Table A the several stories from bottom upward are indicated by Col. (1); the values of the respective "heads" are given in Col. (2) for the corresponding elevations of the radiators; the corresponding gradients in Col. (3); the computed diameters of pipes required to move 3.4 cu. ft. of water through each of the eight radiators, Col. (4); the size of commercial piping which good practice would employ, Col. (5); the percentage of volume flow due to the use of such pipes, as compared with the flow desired Col. (6); the "heads" required to produce the desired flow (3.4 cu. ft. per hour) through the piping employed Col. (7).

TABLE A.

(1)	(2) ft.	(3)	(4)	(5)	(6)	(7) ft.
1	0.1602	1/2722	0.970 in.	1.00 in.	108.	0.1376
2	0.3738	1/1166	0.820	1.00	164.3	0.1391
3	0.5914	1/737	0.740	0.75	103.5	0.5518
4	0.801	1/544	0.700	0.75	118.8	0.5679
5	1.0146	1/429	0.666	0.75	134.5	0.5601
6	1.2282	1/355	0.643	0.75	147.1	0.5674
7	1.4418	1/302	0.625	0.75	158.3	0.5752
8	1.6554	1/263	0.605	0.75	171.2	0.5645

For the use of readers desiring to follow the method of computing by which data in Tables A and B are determined, the graphical tables Figs. 8, 9, 10, 11 and 12 are inserted. By Fig. 8 the values of "heads," expressed in percentages of heights, are found. By Fig. 9 the volumes of flow in cubic feet per hour for pipe sizes from 1/2 in. to 4 in. are given for gradient 1/100. By Fig. 10 ratios are found which, multiplied into the pipe sizes obtained by Fig. 11, give the diameters required corresponding to gradients within the limits of the problem under consideration.

Because "heads" corresponding to frictional resistance to flow are in this instance the same for all circuits of equal pipe size—computed 0.1383 ft. for the circuit of 1-in. pipe, and

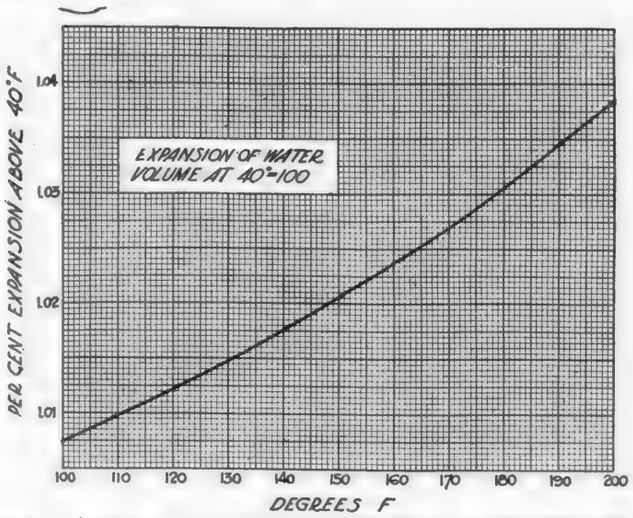
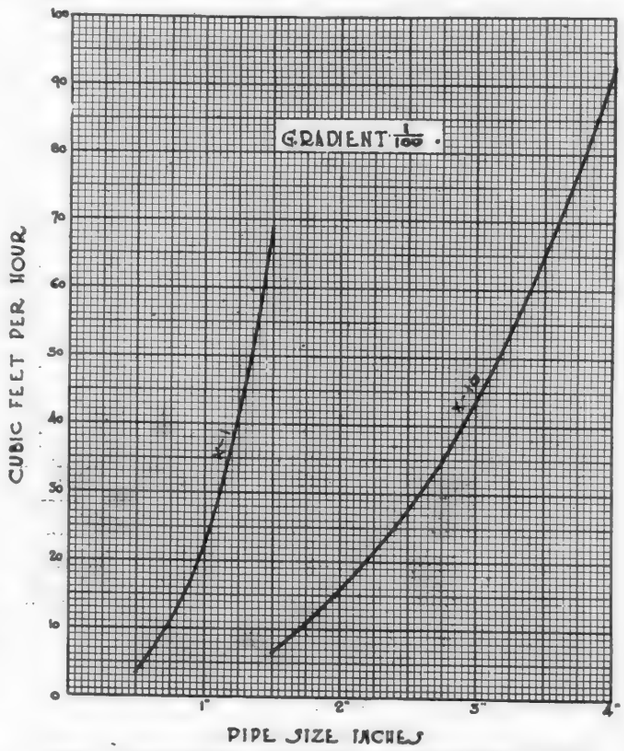


FIG. 8—VALUES OF "HEADS" EXPRESSED IN PERCENTAGES OF HEIGHTS.

0.5664 ft. for those of ¾-in.—it follows that the difference between the several values of "heads," as given in Col. (2) of the above table, and those computed for the 1-in. and the ¾-in. pipe runs must be expended in other work than that of circulating water through the circuit, if equality of flow is to be established. That absorption of the superfluous "head" is the function of the orifice. The actual "heads" are given in Col. (2), the required "heads" in Col. (3), and the surplus "heads" appear in Col. (4) of the following Table B.

TABLE B.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	0.1602	0.1383	0.0219	....	....	....
2	0.378	0.1383	0.2397	8950	0.054	0.265
3	0.5914	0.5645	0.0269	....	....	....
4	0.8010	0.5645	0.2365	8940	0.055	0.266
5	1.0146	0.5645	0.4501	10060	0.049	0.250
6	1.2282	0.5645	0.6537	11200	0.0438	0.235
7	1.4418	0.5645	0.8873	12100	0.0416	0.230
8	1.6554	0.5645	1.0909	12450	0.0393	0.223



FOG. 9—VOLUMES OF FLOW FOR GRADIENT 1/100.

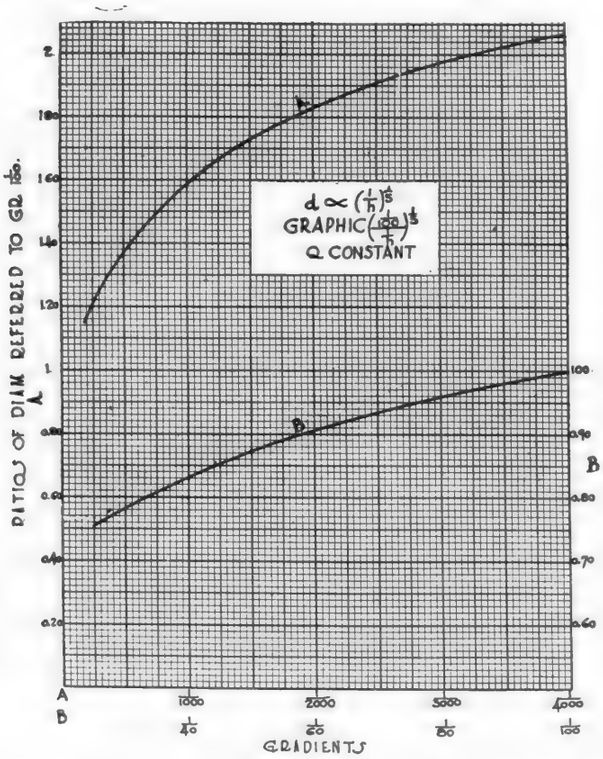


FIG. 10—RATIOS FOR DETERMINING PIPE DIAMETERS CORRESPONDING TO DIFFERENT GRADIENTS.

The flows through 1 and 3 are in need of no correction, being but 8% and 3.5% in excess of that desired. Those through the other radiators are in need of correction. Computations to determine the sizes of orifice to effect such correction may be made by use of graphic tables prepared for the purpose. Fig. 11 shows the velocities of water flow through cylindrical orifies without flared or curved approach, and for "heads" ranging from 0.001 ft. to 1.00 ft. and

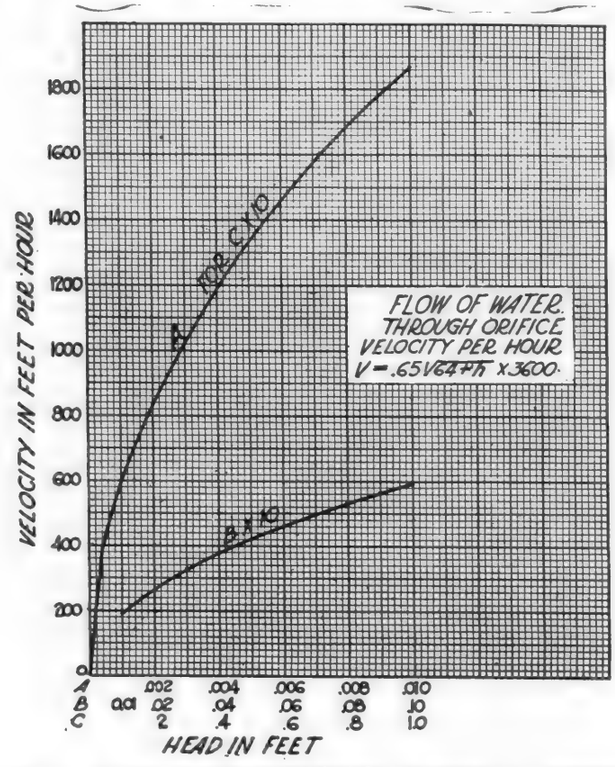


FIG. 11—FLOW OF WATER THROUGH CYLINDRICAL ORIFICES WITHOUT FLARED OR CURVED APPROACH.

corrected for "contracted vein." Col. (5) indicates the corrected velocities in linear feet per hour (found from Col. (4) and graphical table (Fig. 11) corresponding to the several available surplus "heads." The per hour volume (3.4 cu. ft.) and velocities being known, the area of orifice in square inches, Col. (6), and the diameter of orifices, Col. (7) are readily found by the use of the graphical table (Fig. 12).

The purpose of the above presentation is to make evident the impossibility in many, if not in most, cases of controlling water flow through the radiators and convectors of a gravity water heating system by pipe sizes as obtainable and commonly employed, and to demonstrate a possible application of the fixed orifice for that purpose.

EXACT PROPORTIONING OF ORIFICES NOT NECESSARY.

The conditions affecting the service of radiators and convectors are so various, as modified by size and form and elevation of heaters, and rates of flow desired and actual, that computations such as those above employed and applied to each radiator of an extensive, or even moderately large, system would prove tedious, if not impracticable, except by the use of elaborate tables of which present space forbids anything further than mention. It should be noted, however, that an exact proportioning of orifices is not necessary to a sufficient

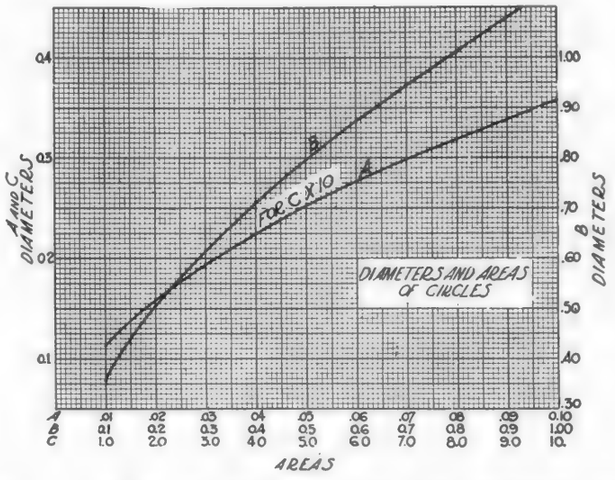


FIG. 12—CHART FOR FIGURING AREA AND DIAMETER OF ORIFICES.

avoiding, or overcoming, of circulation troubles for all practical purposes, because volume flow varies as the square root of motile pressure, and as the square of the diameter of orifice. Methods which are approximate, as by means of adjustable orifices brought to size for wanted service by successive adjustments while connected in place, and for controlling flow through radiators and other heaters, are convenient, and may be made so closely accurate as to leave little in resulting performance to be desired. A brief description of such methods brings to a conclusion the present discussion of the application of the fixed orifice to the several offices named and described in connection with heating systems.

ADAPTATION OF MODULATING AND OTHER VALVES TO THE PROVIDING OF FIXED ORIFICES.

It is commonly desirable to provide stop valves for shutting steam or water from radiators, especially in case of small rooms warmed by one or a few radiators, as in the living and the sleeping rooms of private houses. Any good form of "modulating" valve may serve the purpose of a stop valve. Some makes of that type of valve are also well adapted to provide fixed and closely-adjustable orifices. One of these, the second model of the "Multiport" valve,

furnished exceptional opportunity for adjusting the area of the valve port for eighteen areas of orifice, varying by regular gradations from 0.00 to 0.387 of a square inch for the ¾-in. size of valve. Tested under such facilities as the United States Bureau of Standards affords for such work the actual passage of steam through the several areas of valve, and under the steam pressure indicated, was found to be as shown on the accompanying graphical table, (Fig. 13).

Mechanically this valve proved defective, first, because of the tendency of the cylindrical valve-tube to sufficiently corrode when long unturned to either bind the valve in fixed position, or else to make the turning of the valve difficult. In time also, and especially when applied to hot water service, the "packless" feature of the valve stem was found, after a few years of use, to be unreliable. It is with regret that this valve, otherwise so admirably adapted to the purpose of combined orifice and stop and modulating functioning, should be so structurally defective as to require withdrawal from the market.

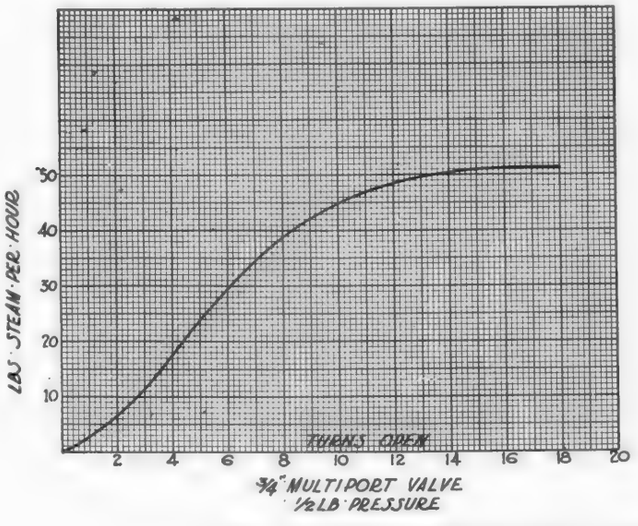
As an illustration of the successful application of this valve to correcting the chaotic condition of water flow through a four-story water heating system of direct radiation with overhead supply, a case is here cited in which, with the piping and ordinary radiator valves as provided, the first and second-floor radiators could not be brought to needed temperature, those of the fourth floor being meanwhile overheated. On the substitution of "multiport" valves for those originally installed, and on giving the top valves an area of port of 0.065 sq in. for 45 sq. ft. of radiator surface, and 0.107 sq. in. for the third floor series, and 0.256 sq. in. for the second floor, and a wide open valve for the ground floor, the flow was equalized and brought within ready control, and modulation in addition provided.

The performance of the latest produced type of "multiport" valve is shown in the graphical table Fig. 14.

The twelve successive stages provided by this valve are of larger capacity value than those of the second type, making it less adaptable than that for accuracy of setting and exactness of performance. Its chief claim to preference is in the elimination of structural defects which characterizes its predecessor.

Experience has proved that each valve of the same class has its own individual characteristics, and that the graphical tables for any one valve cannot be counted on with surety to apply to another valve of the same make and size.

In the absence of better means, a leakless cock may be connected into pipes leading to radiators or heaters, in addition to the ordinary radiator valve. In case of a room heated by several radiators and used for public or semi-public purposes, the radiator valves may be of the lock-shield pattern, set to the requirements of each radiator. In one eight-story overhead distributing water heating system, such valves applied to the four upper stories and closely adjusted to the requirements of a large gravity system spared the installation a condemnation and rejection from which pipe sizes alone could not have saved it.



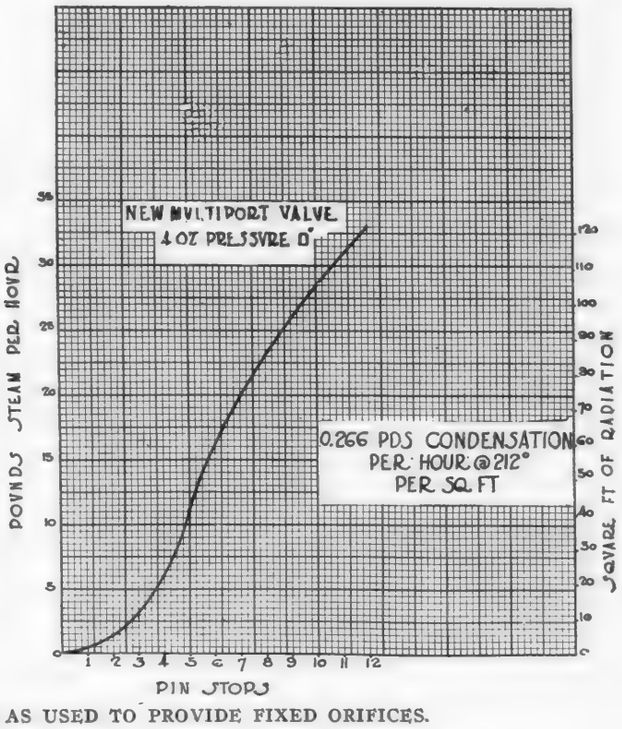

NEW MULTIPORT VALVE
4 OZ PRESSURE
0.266 PDS CONDENSATION PER HOUR @ 212° PER SQ FT
POUNDS STEAM PER HOUR
SQUARE FT OF RADIATION
PIN STOPS

FIG. 13-14—TESTS OF MODULATION VALVES AS USED TO PROVIDE FIXED ORIFICES.

Manifestly the application of the orifice to a steam system is based on other considerations than those which govern in the case of water. In the case of steam the pressure may be made practically the same at every radiator inflow. In that of water pressure varies with every change of radiator elevation.

In the case of steam, the sole office of the orifice is to controllably and automatically apportion the quantity of steam fed to each radiator. In the case of hot water, the office of the orifice is, to so effset first, the effects of unequal "head" or gradient, and second, of inappropriate pipe sizes, as to reliably control the rate of flow through piping and, finally, to fix the rate of flow through individual radiators in accordance with sizes and services.

INSTRUCTION COURSE FOR CUSTODIANS AND JANITORS

Lesson No. III—Low-Pressure Steam Heating

By EDWIN S. HALLETT

Chief Engineer, St. Louis Board of Education.

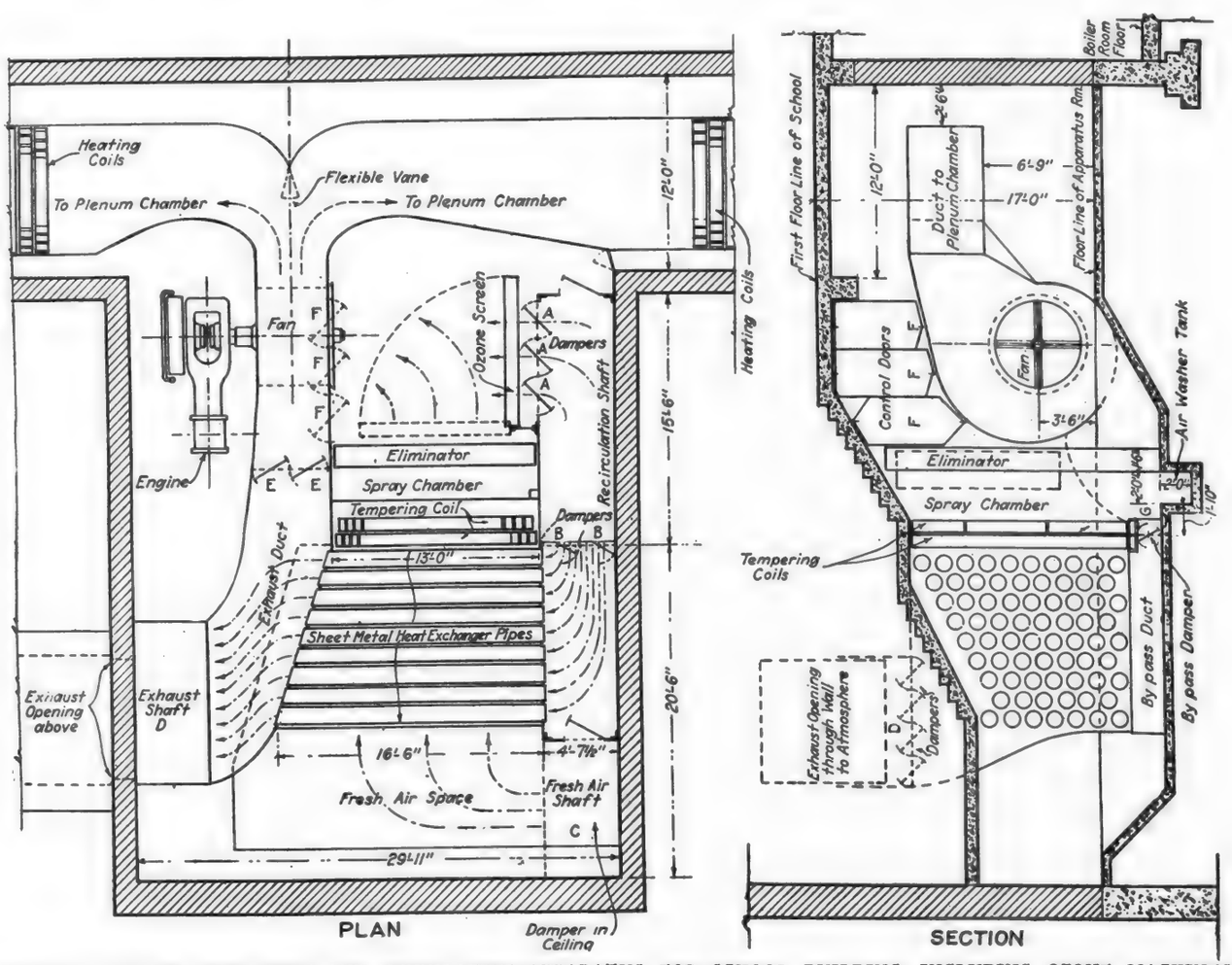
The heart of every steam heating plant is the boiler. The design and style of boilers at the present is so diversified that much time might be given to details of the various kinds but it is deemed better to give such directions as will help the greatest number of readers. Cast-iron sectional boilers are most appropriate in moderate-sized buildings where no steam power is required for fans. They may be enlarged by the addition of sections to some extent.

BURNING LOW-GRADE BITUMINOUS COAL.

Instruction is most needed in districts using low grades of bituminous coal to get good combustion and to avoid excessive smoking. Some are equipped with down-draft grates which are very efficient if the fireman is trained to fire them. Down-draft furnaces have an upper set of grates filled with water and connected to the boiler in such away as to get free circulation through the grate bars to avoid burning them. The coal is fired upon the upper grates and burns downward, and the partially burned coal that falls through the wide spacing of the grates is received by the lower cast-iron grate bars. This produces two fires which burn toward each other and produce a very high temperature. The volatile hydro-carbon of the coal is driven off and must pass through the hottest fire and this is the reason for the smokeless condition.

No fresh coal is ever fired into the "middles" or on the lower grates. The upper grates must be kept covered uniformly and of a depth determined by the draft of the stack. This will be found by experiment. No holes should ever be permitted to come in this fire. As it begins to get thick a slice bar should be put in between the grate tubes and gently lift the coking mass to break it up to admit more air.

Air is admitted through the ash pit only while the middles are covered with coked coal and should be closed as soon as this coal has been burned out. To force this kind of furnace the barring down of the upper grate should be as frequent as may be necessary to keep a good fire in the middles. In skillful hands the down-draft furnace admits of greatly overloading and is very efficient.



TYPICAL LAYOUT OF HEATING AND VENTILATING APPARATUS FOR SCHOOL BUILDING, INCLUDING OZONE MACHINES.

BURNING SOFT COAL ON PLAIN GRATES.

Where the plain grate is used with the bituminous coal it is necessary to make some provision for carburetion as the ordinary use of such furnaces is not only illegal in most cities but is too wasteful to be considered. Throwing fresh coal on a fire drives off 50% of the heating value of the coal in unburned gas. Conditions to be met are simply these: The volatile part of the fresh coal must be liberated gradually by stoking the coal on the front edge of the fire. The rapid distillation of the volatile must pass through the hot flames of the fire and then impinge upon non-absorbing walls or surfaces. The third step to complete the combustion is the admission of very hot fresh air in small jets into the combustion chamber just after leaving the firing bed. No absorption of heat by the boiler should be permitted until the gases have passed this third step. Every effort possible must be made to raise the temperature to the highest degree at this bride-wall position. It may take the form of fire-brick arch or throat or other constriction to produce the concentration of gas mixture and high temperature.

These conditions are readily built into brick settings and the manufacturers of cast-iron boilers are recognizing this demand. Furnaces are now built to burn soft coal with better efficiency than the anthracite burners have done in the past.

FIREMEN SHOULD HAVE PRACTICAL INSTRUCTION.

Practical instructions should be given the firemen and a firm hand laid upon him until he has formed the habit of working by them. He should push the fire back and stoke the fresh coal on the front edge or bar the fire to one side and stoke on nearly bare grate. The coal should be broken into 3-in. lumps and spread at a uniform depth on the grates. An uneven depth limits the effective grate area to the thin spots and these take an excess of air.

Great care must be exercised to prevent air leaks in the furnace and smoke connections. Use a candle or match to detect the suction through possible openings and caulk or patch every one of them most carefully. Make the fire doors fit closely.

ALL-BLAST FAN SYSTEM RECOMMENDED FOR SCHOOL BUILDINGS.

The heating of large school buildings is best done with an all-blast fan system, using steel boilers of standard type and engine-driven fans. It is a matter of personal preference between an all-blast system, with mixing dampers to supply a uniform flow of air, and the split system, furnishing about 40% of the heat in the air for ventilation and the remainder in direct radiation in the rooms.

The improved and simplified all-blast heating and ventilating system is the most economical to build and least expensive to operate and gives the best results in air conditioning to be obtained at present. A brief description of such a system is advisable.

The layout of a heating system should be done in cooperation with the architect to secure suitable and economical use of space. Since the boiler will be in the rear, the intake for fresh air should be on the front and one story high. The apparatus room, containing air washer, ozone purifier, engine and fan, can best be placed in first floor under main stairway. One fan is sufficient for quite large buildings and is arranged as shown in the accompanying plan. The exchanger pipes utilize the heat of the vented air as it passes out, for tempering the fresh incoming air, and take the place of a steam Vento coil. A drying coil may be used after the air washer, and for better control of temperature of tempered air in the plenum chamber, if desired.

After passing through the multivane fan the air, under a static pressure of about 1½ in. water gauge, is divided into two streams to the Vento stacks. It is planned to concentrate the heating coils in two large units near the boiler. A by-pass opening under the steam coils takes the air which has been tempered to about 60° to the lower deck of the chamber, while the air passing through the heating coils is raised to the necessary temperature.

From these two compartments the individual room ducts take air through mixing dampers which operate by air pressure from thermostats in the room. This insures a constant flow of air to each room and the heat control is made perfect by means of graduated thermostats.

(*Lesson No. 4, which will appear in the April issue will explain in detail the operation of the all-blast fan system.*)

SOME TEMPERATURE PROBABILITIES FOR APRIL

By REID DAVIES

The three charts of temperature probabilities for April, shown herewith, represent a continuation of the series which started in the February issue of THE HEATING AND VENTILATING MAGAZINE. In that issue was given a detailed explanation of the meaning of the several curves on each chart and the method of interpretation to be applied, so those details will be omitted in the present issue.

Comparison of the April charts with those for March on either of the three cities, shows a slight increase in irregularity of the curves. While the full explanation of this effect is not known, it is well recognized that during the months of April and October there is likelihood of greater temperature variations from day to day than during any other months in the year. At the time of annual extreme temperatures, low in January at mid-winter, and high in July at mid-summer, there is minimum variation of temperatures from day to day, the tendency being for temperatures to stay fairly constantly low during January, and fairly constantly high during July. These effects are not shown directly in the curves of temperature probabilities, but their influence is reflected in the greater irregularity to which attention has been called. This point will be brought out more clearly when the charts for the entire heating season have been presented.

DAILY RISE AND FALL IN TEMPERATURE.

In addition to the seasonal rise and fall in temperature with cycle period of a year, there is another regular rise and fall in temperature of direct interest to the heating engineer, that which occurs normally within a cycle period of one day. It must be explained in advance that while the tendency to this daily cycle period always exists, it is frequently overshadowed by other effects that may produce occasionally days in which there is practically a constant rise, and days in which there is practically a constant fall in temperature, during the entire period of twenty-four hours. Also the cycle is apt not to be a closed one even when the general rise and fall is experi-

enced. Both of these effects are minimized by consideration of the subject from the standpoint of averages.

One reason why this daily temperature precession is of special interest, lies in the fact that compared to the annual rise and fall, the daily fluctuations occur much more rapidly. The annual temperature variation from record maximum to record minimum is very unlikely to exceed 125 deg. F. and the actual variation for any one year is still less likely to exceed that range. Daily temperature ranges of 35 deg. F. while not common, are not at all impossible. On the basis of these extreme temperature ranges then, it is apparent that the daily variation is accomplished at about one hundred times the speed of the yearly variation. More nearly average conditions might be a yearly range of 100 deg. F. and a daily range of about 10 to 15 deg. F. On this basis the rate of daily variation is from 40 to 50 times the rate of the annual variation.

The fourth chart here shown, represents a plotting of the average hourly temperature readings during April at the New York Station of the U. S. Weather Bureau, covering a period of thirty years from 1871 to 1900, inclusive. This curve has direct application only to the New York district and to April conditions, since in other locations during April and in other months at New York, the conditions would be different. However, the curve has value as a general indication of what happens in every location and during every month of the year in these latitudes.

SIGNIFICANCE OF DAILY VARIATIONS.

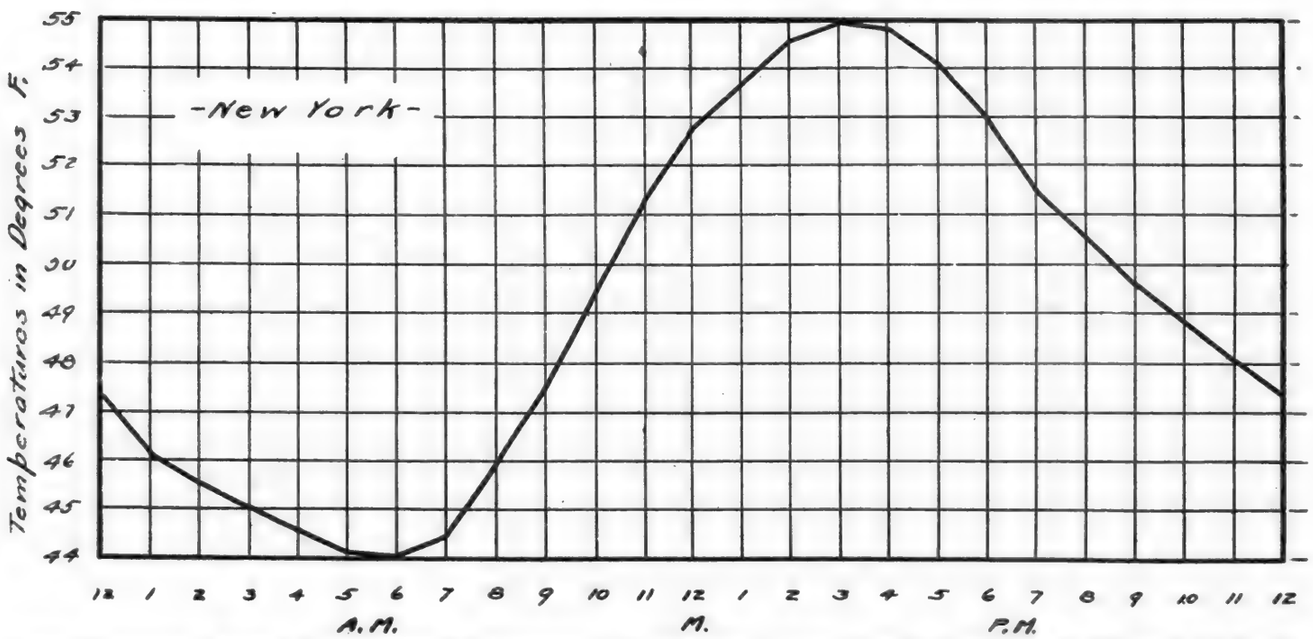
As shown by this curve, the average daily range in temperature for the time, place, and period above mentioned, was about 11 deg. F. It is also apparent from the curve, that there is normally a difference in the time required for the rise in temperature and that consumed in the fall of temperature which alternates with it. For this special curve the rise was accomplished in 9 hours, while it took 15 hours for the corresponding range of fall. The fact that the minimum was attained at about 6 A. M. and the maximum at about 3 P. M. on the average, is of direct interest in connection with the necessary rate of operation of heating plants at different times during the day.

Assuming an average rising hour of 7 A. M. and retiring hour of 11 P. M. and assuming also a need for artificial heating when the outside temperature is under about 50° F., we find that for the conditions of the curve shown, there is a need for artificial heating between the hours of 7 and 10:30 A. M. and the hours of 8:30 and 11 P. M.

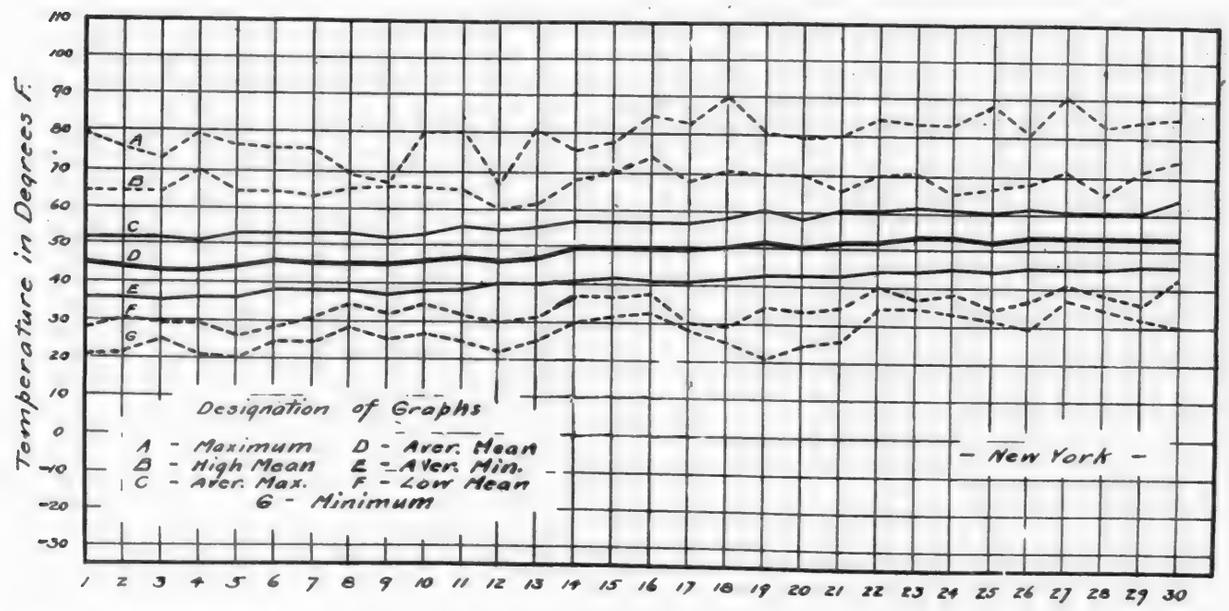
The daily tendency toward alternate rise and fall in temperature is due to the heating action of the sun, but this effect is not confined to days in which the sun is visible from the surface of the earth. Clouds serve to alter the effect, and winds do so to a far greater extent, so that occasionally there will be experienced, within a period of an hour or two, a rise or fall of 20 or 30 degrees in temperature. Rain and snow, while directly caused by temperature conditions, also react on temperatures in a stabilizing direction. The combination of these other effects often serves to obscure the effect of the sun's action and to produce the extended periods of rise and fall of temperature to which reference was previously made.

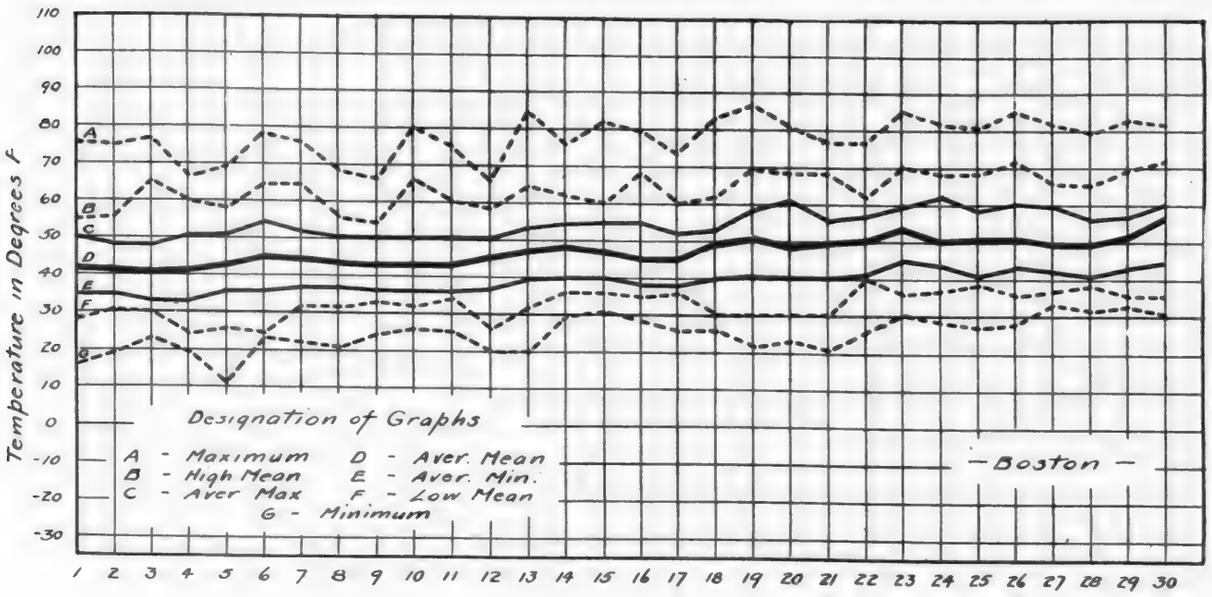
TEMPERATURE RECORDS FOR APRIL, DEG. F.

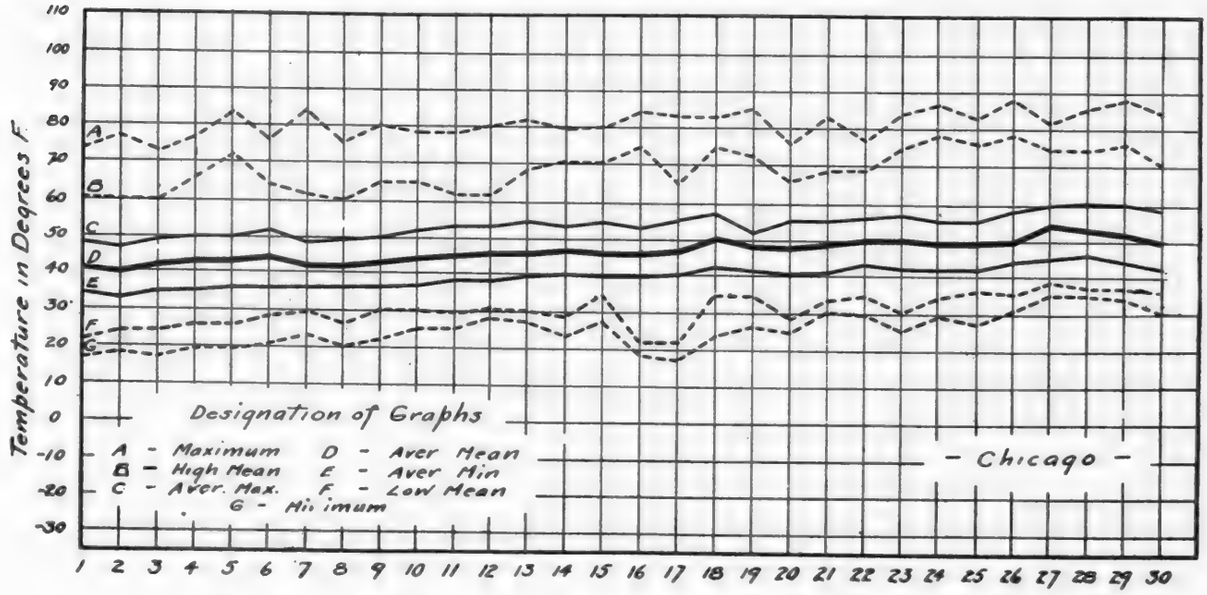
	New York	Boston	Chicago
Record high temperature.....	91	87	88
Highest daily mean temperature	74	72	78
Average maximum temperature..	57	54	54
Average mean temperature.....	49	47	46
Average minimum temperature..	41	39	39
Lowest daily mean temperature..	26	24	22
Record low temperature.....	20	11	17



CURVE SHOWING HOURLY TEMPERATURE VARIATIONS IN NEW YORK DURING APRIL—TAKEN FROM AVERAGE OF READINGS COVERING A PERIOD OF 30 YEARS.







TEMPERATURE PROBABILITIES FOR APRIL IN NEW YORK, BOSTON AND CHICAGO.

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ENGINEERS are at last waking up to the importance of the law that has been enacted in New York State providing for the licensing of all engineers after 1922. Contrary to the general impression, membership in a national engineering body will not be accepted as prima facie evidence of the required qualifications. In fact, so varied have been the interpretations of the act that its salient features are given herewith. Although now a law, its provisions do not become effective until May 14, 1922, which, however, is only a little over a year hence.

The law applies to "any person practicing or offering to practice professional engineering or land surveying" in New York State. A "State Board" is to be appointed for the licensing of professional engineers and land surveyors, to consist of five members, all to be appointed by the regents of the University of the State of New York in Albany and all to be "licensed professional engineers."

Those receiving licenses must first "submit evidence satisfactory to the board that he or she is fully qualified to practice professional engineering or land surveying." An exception to this is only made where a person holds a like unexpired certificate of license in another State in which the requirements are of a standard satisfactory to the board. Licenses, however, are not to be granted to those under 21 or to one who has not been actively engaged for four or more years in the practice of professional engineering satisfactory to the board, and who shall not have had responsible charge of work as assistant for at least one year. In this connection, each two years of study, satisfactorily completed, of engineering in a school of engineering shall be considered as equivalent to one year of such active practice. The act then states:

"Unless disqualifying evidence be before the board the following facts established in the application shall be regarded as prima facie evidence, satisfactory to the board, that the applicant is fully qualified to practice professional engineering or land surveying: (a) six or more years of active engagement in professional engineering work, one of which shall have been in responsible charge of work; (b) graduation, after a course of not less than four years in engineering from a school or college approved by the regents as of satisfactory standing, and an additional four years of active engagement in professional engineering, one of which shall have been in responsible charge of work." Written examinations are only to be required where the evidence originally presented is not considered sufficient.

The fee for practicing professional engineering is placed at $25.00. Each licensed engineer will receive a seal bearing the licensee's name and the legend "licensed professional engineer," which is to be used on plans, specifications and reports.

A number of important exemptions are to be noted from the provisions of the act. These include professional engineers from other States who have no established place of business in this State; employees of licensed professional engineers, providing they do not have responsible charge of design or supervision as principal; and employees of the State. Finally, two years after this act goes into effect or from May 14, 1922, "no county, city, town or village * * * shall engage in the construction or maintenance of any public work involving professional engineering or land surveying for which plans, specifications and estimates have not been made by, and the construction and maintenance supervised by, a licensed professional engineer or land surveyor; provided that nothing in this section shall be held to apply to such public work wherein the contemplated expenditure for the completed project does not exceed $2,000.00."

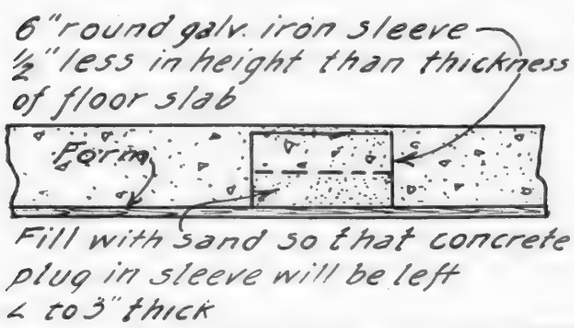
AN ANALYSIS, recently completed, of the circulation of THE HEATING AND VENTILATING MAGAZINE reveals some interesting figures. It was brought out, for instance, that no less than 33% of our readers are strictly heating and ventilating consulting engineers. A little over 12% are heating contractors, while 7% are both engineers and contractors. The number of technical libraries included among the subscribers is significant, comprising nearly 6% of the circulation. The number of manufacturers listed as paid subscribers comes to over 7%. The balance of the classified readers is made up of architects, central station heating engineers and manufacturers' agents, to which should be added a miscellaneous list of 8½%. Although great care was taken in making the canvass, it has not as yet been possible to classify 17% of the readers, but it is probable that this would only raise each percentage a proportionate amount.

WRINKLES

Scheme to Provide for Future Installation of Mushroom Floor Ventilators.

I am submitting a sketch showing an arrangement providing for future installation of mushroom floor ventilators in a theatre. This theatre is being built, but complete ventilating equipment will not be installed at the present time and it is desired to make provisions so that the apparatus can be installed later and the mushrooms set in the floor without it being necessary to cut the holes through a solid concrete slab.

This arrangement gives them for the present a perfectly smooth floor surface in the theatre. The mushroom layout


6" round galv. iron sleeve
½" less in height than thickness
of floor slab
Form
Fill with sand so that concrete
plug in sleeve will be left
2 to 3" thick

ARRANGEMENT FOR FUTURE INSTALLATION OF MUSHROOM VENTILATORS.

is worked out in accordance with the seating arrangement and at each location a 6-in. round galvanized-iron sleeve is set in place on the forms, this sleeve being ½-in less in height than the thickness of the floor slab. The inside of the sleeve is then filled with sand up to within two or three inches of the top and a concrete slab is poured continuously over the entire floor area, including the sleeves. When the forms are removed the sand drops out, leaving a plug in each sleeve about 2 or 3 in. thick. When it is desired to complete this system and set the mushrooms these plugs can very easily be knocked out. This idea is submitted as it may be found useful by others for similar conditions.

Kirkwood, Mo.

F. J. McMorran.

Utilizing the Surplus Heat from a Drying Room.

Nothing is more fatal to production in any building than a cold interior. In a factory in Kennett Square, Pa., a room about 200 ft. square had been fitted up with steam pipes around the outside walls, but the equipment proved to be of insufficient capacity, as it did not bring the heat over near the machines in the center of the room where the girls were working.

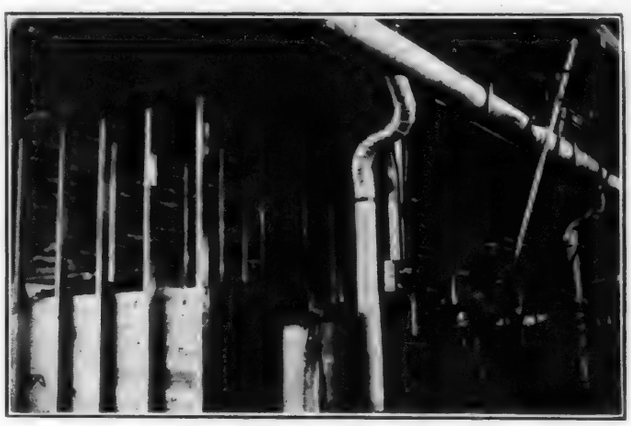
This condition was remedied by the arrangement shown in the accompanying illustrations. A large drying room in one corner was rigged up to be utilized so that the excess warm air was forced through a system of piping by a fan and motor and delivered directly to the machines, thus furnishing a supply of warm air to those points at all times. The system can be regulated by controlling the speed of the fan so that the warm air coming from the drying room will not be exhausted. An auxiliary heat supply was installed in the form of an indirect heater stack.

On top of the dry room a 24-in. galvanized-iron duct was run along its entire length, into which 6-in. feeders

DRYING ROOM AND AUXILIARY HEATING SYSTEM. (MOTOR AND FAN AT LEFT.)

delivered the hot air from the interior of the drying room. After leavng the fan the duct ran 12 in. in diameter to the machines. At that point 6-in. feeders ran down the posts with outlets near the various machines.

The system has proved so effective that it has been extended to all parts of the building, the cost being con-



SIX-INCH SUPPLY PIPES DELIVERING WARM AIR AT MACHINES.

siderably less than an equivalent addition to the original heating system.

The installation was made by Charles Thomas, of Kennett Square, Pa., a practical sheet metal worker.

A Handy Radiation Chart.

The Stefan-Boltzmann radiation law is acknowledged to be as good as any. The trouble with it is, however, that most people who have to figure radiation do not like to use it because temperatures in it are given in degrees Fahrenheit absolute, raised to the fourth power, which take considerable time to compute. I have therefore prepared the accompanying

chart, which takes care of the absolute temperature feature and also takes care of the process of raising to the fourth power and dividing by one hundred. The law as given by Stefan-Boltzmann is as follows:

$$H = CAt \frac{(T)^4}{(100)}$$

where H = heat radiated in B. T. U.

C = a constant

for smooth glass	0.154
dull brass	0.0362
lampblack	0.154
slightly polished copper	0.0278
dull oxidized wrought-iron	0.154
clean, bright wrought-iron	0.0562
highly polished wrought-iron	0.0467
rough cast-iron highly ozidized	0.157
water	0.112
ice	0.106

A = area of radiating surface, sq. ft.

t = time in hours

T = temperature degrees Fahrenheit absolute.

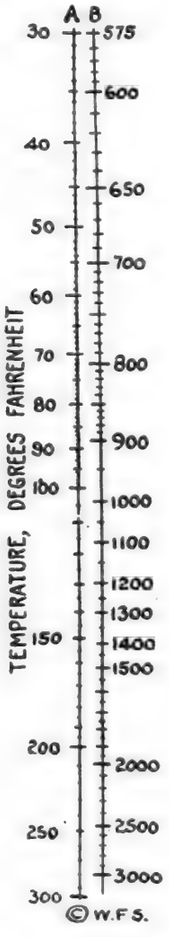


CHART FOR COMPUTING RADIATION.

It is not very well known, but it is a fact that this formula can be applied very nicely to problems where it is desired to determine the radiation due to increase or decrease of temperature.

Using the accompanying chart, the computation is accomplished as follows:

Find the temperature in degrees Fahrenheit in column A, and in column B the corresponding figure is found the absolute temperature divided by 100 and raised to the fourth power all worked out.

For example, what is the radiation in 10 hours from a rough cast iron surface whose area is 10 sq. ft., the temperature of the cast iron being 40° F.?

Referring to the chart, find 40° F. in column A. Opposite in column B is the figure 625. For cast iron the table gives us the constant 0.157. We therefore find the radiation to be

0.157 x 10 x 10 x 625 = 9820 B. T. U.

If this is the normal temperature of a room and if the cast iron object is a radiator and it is desired to maintain the temperature of the radiator at 250° F. how much steam is radiated in 10 hours?

Our formula now becomes:

$H = CAt\ (T_1 - T_2)$ where

T_1 = the higher temperature value given in column B of chart;

T_2 = the lower value given in column B of chart.

Find 250° F. in column A. Opposite that figure in column B is the figure 2550. Substituting in our formula we now have:

0.157 x 10 x 10 (2550 — 625) = 30250 B. T. U.

Inversely, if the normal temperature of the room is 40° F. and if the cast iron object is to be used as a "cooler" instead of as a heater and if brine is to be circulated in the cooler maintaining it at a temperature of 30° F., how much heat will be absorbed by the cooler, or "radiated into it" in 10 hours?

Opposite 30° F. in column A on the chart we find in column B the figure 575. Substituting this in our formula we find that

0.157 x 10 x 10 (625 — 575) = 785 B. T. U.

This chart is made to include most of the temperatures dealt with in average practice. Where temperatures are extreme, the original formula can be used, which is as follows, where there is a change of temperature:

$$H = CAt \left[\left(\frac{T_1}{100}\right)^4 - \left(\frac{T_2}{100}\right)^4\right]$$

where all factors are as given above with the exception that

T^1 = Higher temperature absolute, in degrees Fahrenheit.

T^2 = Lower temperature absolute, in degrees Fahrenheit.

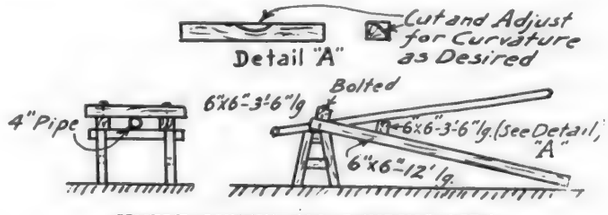
To find the absolute temperature in degrees Fahrenheit add 460 to the temperature as given on the thermometer. Thus 40° F. as given on the thermometer is equal to 500° F. absolute.

W. F. SCHAPHORST.

Device For Bending Pipe.

Having in mind the "Pipe Bending Hints," as related by W. F. Schaphorst in the January issue, the following sketch is submitted as a simple outfit for bending pipe which may be used in lieu of more elaborate apparatus.

The principal part of the outfit consists of two 6-in. by 6-in. timbers 12 ft. long, with a 3½-ft. timber of similar size bolted across the end, as shown. This end of the frame



SIMPLE OUTFIT FOR BENDING PIPE.

is laid on a sawhorse or pile of bricks or stone, one end of the pipe to be bent being placed beneath the cross timber, and another cross timber, modified as shown in detail A, placed across the frame beneath the portion of the pipe which is to be bent. Downward pressure may then be applied to the free end of the pipe, causing it to bend under the unfixed cross timber.

LEGAL DECISIONS

Evidence As to Acceptance of Heating Plant.

Under the terms of a contract providing that a heating plant must easily heat a building to a certain temperature, which contract and guaranty is for the duration of one year, and where the testimony shows that the plant on the first test operated successfully, and that the purchaser's agent at that time believed the plant complied with the contract and accepted it, but there was no waiver of the terms of the contract that the plant should successfully do this for the period of one year, the Mississippi Supreme Court holds, Town of Hickory v. Lemmes, 86 So. 273, that an instruction to the jury was erroneous which warranted the jury in believing that the plant was accepted immediately after this first test. This testimony would only warrant the jury in believing that the plant properly heated the building upon the first test.

How Change of Heating Rates Affected Combination Contract.

The Illinois Public Utilities Commission holds that a customer of a utility who receives gas, electric and heating service under a combination contract, recognized in the company's filed schedules thus: "Customers who have contracts covering both heating and electric service in same contract, are billed at rates which are made up of fixed charge per month or year, plus a charge for current. The fixed charge covers both heating and electric service. The current charge varies according to the quantity consumed" is not affected by proceedings by the utility for a change in heating rates upon published notice to steam users only, and that the rates in the filed schedule remain the legal rates to be charged for the services rendered thereunder, until a proposed change shall be plainly indicated in a new schedule filed with the commission.

Coal Consumption In Water Heating.

Coal consumption is the big factor in the consideration of a water heating rate case. Central station heating service is nothing more or less than transmission of heat units contained in coal at the plant, by the medium of water, to the premises of patrons, where they are released by radiation.

The records of the Indiana Public Service Commission contain much expert testimony and data covering the operation of numerous water heating utilities in Indiana. These utilities are of three types: (1) Isolated heating utilities that have no connection with any other utilities; (2) plants connected with and secondary to electric utilities; and (3) water heating utilities that have connected with them electric operations which are wholly secondary to the water heating operation. Such expert evidence in the hearings of more than thirty rate cases, and records of operation of all such utilities in the State, establish pretty definitely a standard of efficient operation as measured by pounds of coal consumed per square foot of radiation per season. Where a company's plant, belonging to the second class mentioned, is operated in a compact district, the commission was of the opinion that 80 lbs. of coal consumption per square foot of radiation per season, should be the maximum allowance for coal, until such time as the utility should present records of accurate and acceptable tests covering a heating season.

CHATS WITH UNCLE BEN

Making the Chimney Do Double Duty in a Warm Air Heating System.

I MET Uncle Ben one day last summer. He is getting pretty white around the ears, and his pate shows some wear where he has been too assiduously carrying a hymn book in his hat, yet the old fellow is pretty vigorous and over our cigars he opened up a little on some of his wrinkles.

We were discussing the application of hot air furnaces to houses, and of the things which could be learned in hot air practice from water, vapor and steam heating practice, if only the hot air people would use their heads a little more.

He said, "I've had a summer home, as you know, upon my farm, for a good many years. When I built the first house, I had some unfortunate experience with fire, and as it was a frame house I determined that I should not burn down the second one with the chimney or heating plant. I believe that hot water circulates because of a head created by the tendency of the lighter heated water to rise, and the cooler water to fall. Most of us know that we can make hot water do great stunts climbing over hickeys, if we can only get a start by getting a good rise first; that is, if we run from the boiler first to the attic, then down, we can run below the boiler, even, underground, and heat a garage or such out in the back yard. Hot air doubtedly will follow the same law."

"I am sick and tired of putting a furnace in the basement in the good, old wrong way, with the pipes running all over the basement ceiling and then up little tin flues between the studs and maybe between the joists to floor registers. You know how some of 'em will work and some won't, and how there is always some contrary one that bucks, and how most of the heat wants go up the chimney? Well, I built this house to fit the furnace, I'll admit, but there is no reason why any ordinary house adopted to hot air heating can't follow my scheme fairly well."

First I built a chimney as big as all the ordinary hot air ducts or risers combined, running it straight up from basement or attic. At the second floor ceiling I racked it into an ordinary chimney, 9 in. x 9 in., with 9 in. walls where it passed through ceiling and roof. The walls below were over 4½ in. thick. In my house the flue was 18 in. x 36 in. below the second floor. Right up through the middle of this brick flue I ran a steel smoke pipe, 9 in. in diameter, connecting it with a flanged and bolted joint to the bottom of the corbeled-in 9 in. x 9 in. brick chimney at the second floor ceiling.

"At the bottom of the chimney, in the basement, I set the furnace, bricking it in tight, with a 6 in. thick brick cover, carried on No. 20-gauge corrugated steel resting on the side walls. I put a cast-iron manhole door in the chimney, which gives access to everything, and through which in time I can renew the vertical steel flue, though my experience indicates that such a flue will last indefinitely—much longer than a horizontal smoke pipe.

"About 4 in. above the floor I put the registers, where the big chimney, or rather hot air flue, touched the rooms to be heated. Near the ceiling of each story I put horizontal ducts where the rooms to be heated did not abut on the chimney. You will note that rooms some feet away had the advantage of about eight feet more vertical dis-

tance, or heat than those near by. All openings had adjustable registers, and I had the advantage of the heat from the smokepipe for some sixteen feet, while my fire risk was cut down by a brick hot air flue forming an air space around the fire conductor."

"Well, you may not believe it, but the burning of a mighty small amount of fuel is enough to take the chill off that house, and the heat stored in all that brickwork keeps things going all night and serves as an equalizer or reservoir to compensate for intermittent firing periods of the furnace."

Corridor ceilings may usually be 18 in. or so lower than room ceilings, so that the horizontal ducts can be concealed where any may run across the ceiling to reach the rooms, and they can be properly insulated and periodically inspected through trap doors, as they need not touch any woodwork. This is a great advantage from a sentimental standpoint anyway in considering fire risk, over the usual 3½ x 14 in. hot air riser stuck tight against joists and studs."

The more I thought about it, the more I believed Uncle Ben had done something, and last fall when I went duck hunting on his lake with the old fellow, I stayed in his house and on some very nippy mornings in my comfy room in his house, I found ample evidence to verify his contention.

CORRESPONDENCE

Water-Line Troubles In Steam Boilers.

EDITOR, HEATING AND VENTILATING MAGAZINE:

I am a subscriber to your valuable magazine, and as such am endeavoring to impose upon your good nature to the extent of asking your aid in solving the attached sketches, Figs. 1 and 2. In these sketches the location of boiler and matrices of a newspaper publishing press room are fixed; no greater head than 12 in. is obtainable.

Will you please send me a sketch of how this piping should be changed so that the matrices will all operate evenly, and the condensation be removed? At present the condensation stays in the matrices, and the water-line in the boiler gets so low that it operates a low-water cut-off

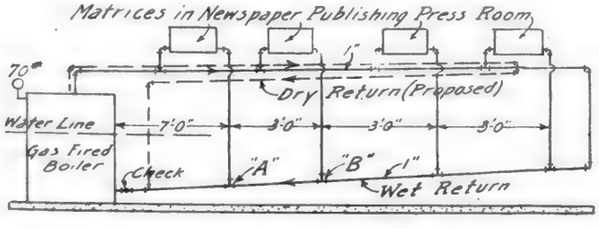


FIG. 1—SKETCH OF PIPING TO MATRICES, CAUSING UNSATISFACTORY OPERATION OF GAS-FIRED BOILER.

valve, and shuts off the gas fuel supply to boiler. Referring to Fig. 1. I believe that the pressure at "A" is greater than at "B," so that condensation is held back and that if the piping is changed as shown in Fig. 2 or as shown dotted in Fig. 1, the difficulty will be overcome.

Portland, Ore. A. E. F.

One of the common causes of water-line troubles in steam boilers is insufficient distance between the normal water-line of the boiler and the radiation, to take care of the inequality in pressure in the heating system. In the accompanying drawing (Fig. 3) selected from the catalogue of the United States Radiator Corporation, if the boiler is filled with water to normal water-line at center of gauge glass, valves Nos. 1 and 2 closed, and No. 3 opened, the water will stand in the open pipe "A" at the same height as the water in the boiler.

If a fire is built in the boiler, the steam generated, being unable to escape through the pipe "B," will accumulate a pressure which will raise the water in the pipe "A." As the pressure increases, the water in the vertical pipe "A" will be raised unless the static head of water balances the steam pressure. Every pound of pressure generated will raise the water in the pipe "A" approximately 28 in. If the steam pressure were raised high enough the water would be driven out of the top of the vertical pipe.

In an enclosed steam heating plant a similar condition exists, the water in the vertical return pipes balancing the

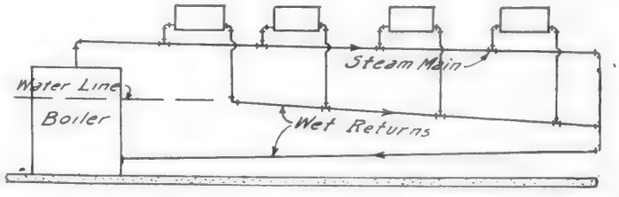


FIG. 2—METHOD PROPOSED BY CORRESPONDENT TO ELIMINATE DIFFICULTIES.

difference in pressure created by the condensation of the steam and pressure loss due to friction.

If valves Nos. 1 and 2 are opened, and No. 3 closed, the water stands in the return pipe "D" at the normal water-line level; when steam is formed in the boiler it flows through the vertical pipe "B" and is distributed to the radiators through the horizontal pipe "E." As the steam is condensed its pressure is lost. The frictional loss due to the steam passing through fittings and pipe always causes a drop in pressure, and if the pipe "E" is long, or too small, this loss in pressure becomes a very important consideration and, added to the natural drop in pressure due to the condensing of the steam, results in a material difference in pressure in the system at the points "B" and "F."

As an example, assume that the steam supply main "E" is 125 ft. long, and its size has been determined to allow for a pressure drop of 3 oz. When the steam gauge on the boiler registers 2 lbs., a steam gauge if placed at "F" would show 29 oz., and to equalize this difference in pressure the water in pipe "D" would be raised approximately 5¼ in. (1.732 in. per pound) to a line indicated by X-X′.

Water standing at the height X-X′ represents balanced pressures in the system. However, as steam is condensed, it is necessary to return to the boiler the water accumulating in the pipe "D." To do this the pressure in pipe "D" must exceed the pressure in the boiler, requiring an additional 4 in. of head, making total elevation of 9¼ in. in the return, as indicated by the line Y-Y′.

On account of the high frictional loss often found and increased pressure drop when system is first heating, it is advisable to maintain a distance of at least 18 in. (preferably 24 in.) between the normal water-line and the point "F," which is the low point of the dry return.

If the total pressure loss in the steam line between the boiler and the end of the line is assumed as 1 lb. at times of maximum load, the rise of water, under the assumed conditions, will be 1 lb. ÷ 0.43, or 2.33 ft., since the weight of a vertical column of water is 0.43 lbs. per square inch for every foot of height. As a general rule, it is customary to allow less pressure drop and to keep 18 or 24 in. between the normal water-line and the high water-line established

when the system is in operation. In other words, the lowest point of the steam and the radiation is kept 24 to 30 in. above the water-line of the boiler.

The high water-line should always be calculated to keep at least 6 in. below the steam main or lowest level of radiation, so that, with 30 in. difference, the water rise could not be over 24 in., with 24 in. difference the rise could not be over 18 in., etc. If 1 lb. = 2.3-ft. rise, then 16 ozs. = 2.3 × 12, or 28 in. and 1 oz. = 1.8 in. rise. This results in a table for allowable rise as follows:

TABLE NO. I.

Allowable Rise of Water in Return Mains Inches.	Allowable Loss in Pressure in Steam Mains, Pounds.
3.5	⅛
7	¼
14	½
28	1
42	1½
56	2
70	2½
84	3

When the total allowable loss has been determined, the loss per 100 ft. of run must be calculated and the size of main based on tables computed on such losses. (See Standard Data Sheets Nos. 128-A to G inclusive and various others as published in THE HEATING AND VENTILATING MAGAZINE.) Such tables also vary according to the kind of system (one or two-pipe and dry or wet return), boiler pressure, flow of condensation with or against the steam, covered or uncovered steam mains, and the amount of steam flowing as determined by the square feet of connected radiation or other condensing surfaces. (The last two items were not stated by the correspondent.) A system in which the drop in pressure can be made 5 lbs. will utilize smaller pipe sizes than the same system designed for a 2-lb. drop, owing to the fact that the lower drop requires larger size pipe to reduce the pipe friction to the extent required. Thus, the piping shown in Fig. .1 and 2 is of 1-in. size throughout and its capacity at low pressures in square feet of cast-iron direct radiation will vary according to the following table in which the pipes are assumed as covered and insulation 100% efficient.

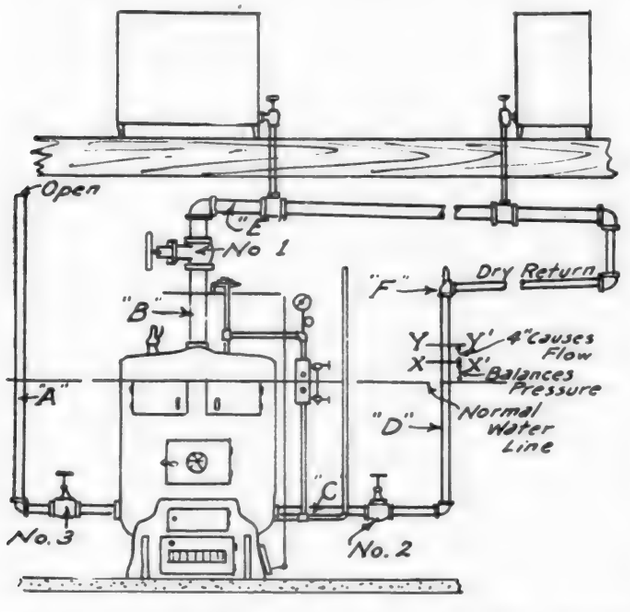


FIG. 3—CONDITIONS OFTEN FOUND IN HEATING SYSTEM WHICH NECESSITATE A MINIMUM DISTANCE OF PIPING ABOVE BOILER WATER LINE.

TABLE NO. 2.—RADIATION SUPPLIED BY 1-IN. PIPE UNDER VARIOUS CONDITIONS.

Drop in Pressure in lbs.	Distance 100 ft. Steam Pressure 2 lbs.	5 lbs.	Distance 200 ft. Steam Pressure 2 lbs.	5 lbs.
⅛	72	78	51	53
¼	102	104	72	78
½	145	156	102	104
1	204	222	145	156

If the allowable rise of return level is 12 in., then, from Table 1 by interpellation, 12 in. = 0.43 lb. drop; and if the total length of the main from the boiler to the farthest connection to the return main, plus 25% for fittings, valves, etc., should equal 30 ft. (approx.), as estimated from the conditions in Fig. 1, then the drop per 100 ft. must be 0.43 lb. ÷ 30/100 = 1.43 lb. per 100 ft., or equivalent. Thus, for the conditions as roughly sketched by the correspondent and his statement that no greater head than 12 in. is obtainable (presumably only between the normal water-line and steam main), the total pressure drop is limited to 0.43 lb. For the given distance this is rather high, being at the rate of 1.43 lb. per 100 ft. while the high water-line would be up to the steam main instead of 6 in. below it, which, as previously stated, is the usual custom. Furthermore, according to a well-known formula in "Steam" by Babcock & Wilcox Co., a pipe of only 1-in. size and a length of 30 ft. will deliver 143.3 lbs. of steam per hour at 70 lbs. gauge pressure with a total pressure drop of 0.43 lb. This is equivalent to a load of 514 sq ft. of cast-iron direct radiation under standard heating conditions of about 3 lbs. gauge pressure.

Sometimes the friction of fittings may be much greater than 25%, even as much as 100%. Therefore, when more accurate results are desired, the fittings, valves, etc., can be counted and the actual equivalent length of piping computed. For this purpose the friction of each fitting and valve must be assumed as equivalent to an added length of run as shown in published tables. (See Standard Data Sheet No. 129-I.)

A method which can easily be memorized is to allow 60 pipe diameters for the "entrance," each globe valve and each tee, where the steam passes through the branch, and 40 pipe diameters for each 90° ell; tees passed through on the run and gate valves may be neglected. The "entrance" friction is the friction occurring when the steam enters the pipe. As an example of the above, one globe valve on a 1-in. line is equivalent to (60 diameters X 1 in. = 60 in.) an additional 5 ft. of run.

The correspondent writes that he believes the pressure is greater at "A" than at "B" (see Fig. 1) and if by this is meant a lesser drop in pressure from the boiler to the nearer point, than to the farther point, he is undoubtedly correct in his reasoning and the partial cause of the difficulties may then be readily shown as in Figs. 4 and 5. These sketches show the wrong and right methods of piping to radiators so that short circuiting will be avoided. In Fig. 5 (corresponding to Fig. 2) the distance from each radiator to the boiler is balanced so that whatever the drop on the line may be, the relation to the return and the drop through the radiator will be the same. In Fig. 4, (corresponding to the conditions in Fig. 1) the water in the return must flow from a lighter and against a heavier pressure and this would tend to retard and hold back the condensation in the farthest radiators from the boiler.

The proposed alterations to the system, as shown dotted in Fig. 1, are open to the same objections as outlined for Fig. 4. Still further difficulties would be created unless the drip from the end of the steam main is water-sealed, as shown in Fig. 6. This prevents steam from short-circuiting directly into the return without passing through a matrix, and therefore causes a slight difference in pressure to exist between the steam and the return main. The flow through the matrices will also be more positive with less air binding, since steam cannot enter from more than one direction and force condensation back through the return into

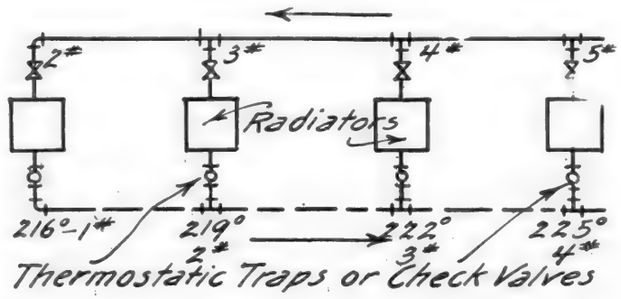


FIG. 4—WRONG ARRANGEMENT OF PIPING TO AVOID SHORT CIRCUITING.

the matrices. Some provision should be made for draining the seal and cleaning out. A brass plugged tee or nipple and cap may be used for this purpose. The depth of seal necessary is determined by the difference in pressure existing at that point, being about 2 ft. in depth for each pound difference in pressure.

It should also be borne in mind that a dry return carries steam which is of much greater volume than when condensed to water, and therefore must be of larger size than a wet return, the volume of condensate being only about 0.0034 times that of the steam at 70 lbs. pressure. Dry returns, because of the steam and their greater radiat-

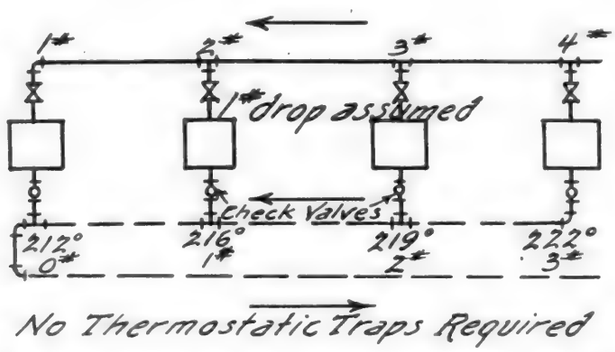


FIG. 5—CORRECT ARRANGEMENT OF PIPING TO AVOID SHORT CIRCUITING.

ing surface due to increase in size; will condense more steam, and because of the steam flowing, will give a greater drop in pressure. At higher temperatures corresponding to the high pressure carried in the installation in question, the radiation loss in transit would be intensified, in pure ticular if the mains are not covered. Furthermore, the piping shown is uniform in size throughout and unless the system is proportioned for size to equalize the drop in pressure at all points, the water-line will be higher in "B" than at "A" (See Fig. 1); consequently where the head room is limited, condensate is more apt to be retained in the matrices farther from the boiler than those nearer, in particular when the cold system is started up. With a sealed return the circulation will always be more positive, or under better control. Incidentally, Fig. 1 shows the main pitched so that condensation must flow back against the steam, a condition which makes for difficulties, especially where high steam velocities and a pipe of only 1-in. size are used.

If a dry return is used, as in Fig. 1, another remedy is to water-seal the whole return by establishing a false water-

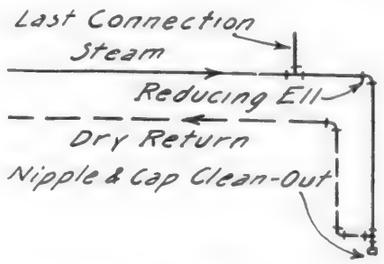


FIG. 6—WATER-SEALING THE DRIPS BEFORE CONNECTING END OF MAIN TO RETURN.

line, as shown in Fig. 7. This can be done if there is sufficient room between the level of the steam main and the level of the return main. Usually about 24 in. difference is the minimum which will give satisfacton, the false water-line being about midway between the two levels, thus giving 12 in. of water seal and 12 in. from the false water-line to the steam main for drainage.

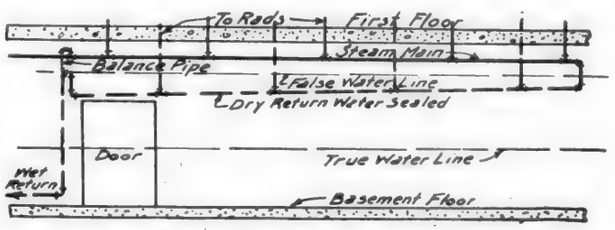


FIG. 7—RETURN WATER-SEALED BY ESTABLISHING FALSE WATER-LINE.

The rise in the return pipe made to establish such a false water-line must be connected to a small line from the steam main, this line being called a "balance" pipe and shown in the sketch. Its real purpose is to admit steam to the top of the riser so as to break syphonic action. Without such a balance pipe the return main will fill up with water

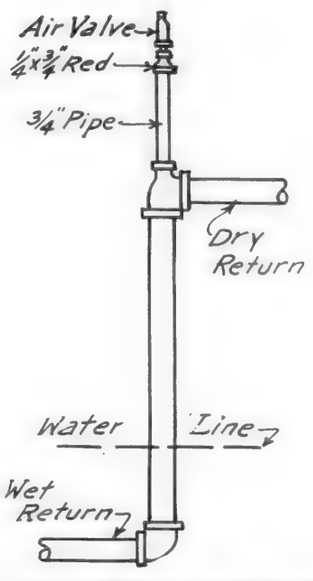


FIG. 8—AIR VENTING OF RETURN MAIN.

until the level of the false water-line is reached and the water will then overflow down into the lower level., Owing to the longer leg on the low side of the rise, a perfect syphon is created which will not only pull all the water out of the high portion of the return main, but will also unseal all connections to it and at the same time cause the water to return to the boiler in intermittent slugs, thus fluctuating the water-line. The amount of such fluctuation will depend on the relative capacity of the water contained by the false water-line which is syphoned out and the area of water surface in the boiler.

A dry return quite often causes an unsteady water-line unless the air is relieved from the point where it drops to the water seal, somewhat as shown in Fig. 8. Air will collect at this point since it cannot return against the steam and condensate, nor can it be forced downward through the water seal. It is caught between the two and must be relieved, either by an air valve or by a radiator which being nearby, may be connected at this point.

Elimination of moisture from the steam will sometimes be of help. A boiler will prime if it is not thoroughly blown out and provided with clean water, or if it is poorly proportioned and with but little steam space. Sometimes the water passages are so designed that high velocities result, in particular when the boiler is forced beyond its rated capacity, but more often excessive quantities of foreign or organic matter are the cause of foaming, a condition similar to priming. Both are the cause of water entering the pipes, especially when the rise is limited so that it is good practice to use several outlets from the boiler. If each of these is made the size of the main, the velocity of steam leaving the boiler will be cut down and carry over less entrained water.

Another remedy for this condition is to make up a separator from standard pipe and fittings and install it on the steam main at the boiler to take care of any sudden influx of water. This may be designed with a diameter twice that of the steam main so that the velocity of the steam through the separator is decreased by the larger area it affords. Inlet and outlet ells should be turned at different angles in order to change the direction of the steam in its passage through the separator. The bottom of this device should be drained back to the boiler.

Functions of the Orifice in Steam and Water Heating.

EDITOR, HEATING AND VENTILATING MAGAZINE:

I have been following with much interest the article by Professor Woodbridge, as I intend to work out the system for some heating plans here. I note that Figs. 2 and 3 have been corrected in your January issue.

In working out the size of orifice to deliver 695 lbs. of steam per hour, Napier's formula, which you use, gives the size as 0.99 in. diameter, yet it hardly sounds reasonable to deliver that quantity of steam through an orifice of 0.99 in. on low-pressure steam heating systems.

Under the heading of "Pipe Sizes," (Page 31, January issue) you refer to Fig. 5 to obtain the steam flow through pipes, but do not state what the curves, X-1, X-10 and X-100 represent.

Referring to the diagram shown in Fig. 4, I do not grasp the idea for supplying the main "Q" from an orifice "R" since "R" is shown midway between the branch to radiator "A" and the main supplying radiators "J' to "P.'

Where is section "T,' as shown in Table II? I would assume that steam would enter at R_1 and the pipe sized from Table II, and the orifice at the inlet and outlet of the radiator sized from Fig. 3.

Atlanta, Ga. G. H.

Regarding the size orifice used, 0.99 in., to deliver 695 lbs. of steam per hour, Professor Woodbridge writes: "The amount of steam which will pass through a small orifice formed to eliminate contraction of vein, and under low pressure, is to many surprising. Let your correspondent attempt ot get up 3 lbs. gauge pressure in a rated 20 H. P. boiler, firing at the rate of 60 lbs. of coal per hour, and with such a free 0.99-in. aperture between the steam within and the air without the boiler, and I am sure he would not longer question the probable accuracy of the statement made. He would find that 2.6 lbs. steam pressure within the boiler would discharge 695 lbs. of steam per hour."

As to the steam flow chart (Fig. 5), he states: "In making up graphical tables, it is convenient to place upon one chart more than one curve, often as many as three, all of which refer to the same ordinate or abscissa figures. In this case, for the first (left-hand) curve, the pounds of steam per hour for any size of pipe up to 1½ in. are read off on the vertical, or ordinate, column of figures. For the second curve, the steam quantities are read off in the same manner for pipe sizes from 1½-in. to 4-in., the readings in this instance being multiplied by 10. For the third curve, the readings for pipe sizes from 4-in. to 8-in. are multiplied by 100.'"

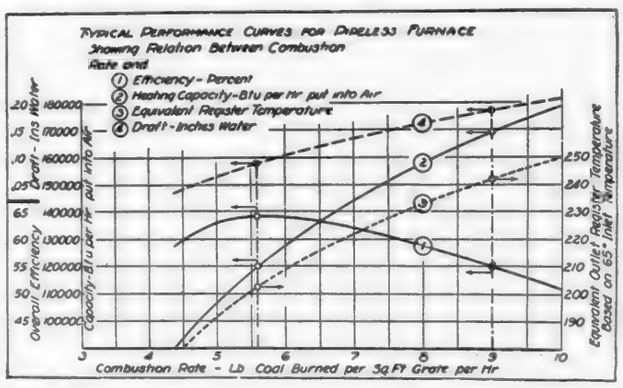
In Fig. 4 the main "Q" is supplied from an orifice "R_1" instead of "R." The letter "T" appears to have been crowded off the drawing. "T" is the pipe connecting branches "A" and "I" with the main. In Table II "A and T" should read "A and I." Also the heading of Table II should read, "Schedule of Pipe Sizes Based on Fig. 5."

Furnace Design and Performance.

EDITOR, HEATING AND VENTILATING MAGAZINE:

The correspondence on "Furnace Heating Problems," in your January issue, raises several important questions regarding the warm-air furnace. If "less engineering effort" has been applied to improving the furnace than the boiler, it is due largely to the lack of capable engineers to solve the problems involved in furnace design. The engineering problems involved in boiler design are simple compared with the intricate ones involved in furnace design.

Until recently there were no instruments by which accurate measurements of air flow or temperature rise through the furnace could be determined, or reliable methods developed for


TYPICAL PERFORMANCE CURVES FOR PIPELESS FURNACE
Showing Relation Between Combustion Rate and
1 Efficiency - Percent
2 Heating Capacity - Btu per Hr put into Air
3 Equivalent Register Temperature
4 Draft - Inches Water
Overall Efficiency
Draft - Ins Water
Capacity - Btu per Hr put into Air
Equivalent Outlet Register Temperature Based on 65° Inlet Temperature
Combustion Rate - Lb Coal Burned per Sq Ft Grate per Hr

TYPICAL PERFORMANCE CURVES FOR PIPELESS FURNACES.

calibrating those instruments. The research bureau established at the University of Illinois and financed by the Furnace Manufacturers' Association has spent nearly three years of constant effort in developing the Wahlen gauge and suitable air-measuring tanks so as to accurately calibrate anemometer readings, besides developing the potentiometer and suitable thermocouples for temperature measurements. The data obtained from the Pitot tube and anemometer in measuring such low velocities as are found in furnace testing was prac-

tically worthless. The temperature reading of the air at the furnace outlet by the Government standard thermometers was found to be about 60° too high, due to effect of radiant rays.

To determine the number of heat units passing through a leader pipe from a furnace is a very intricate problem when you consider the wide variation of temperature in a traverse of the pipe, also the different velocities at which the air is moving, due to the stratification of the gases because of the variation in temperature and friction. A temperature traverse of a 10-in. leader pipe showed a range of temperature from 115° at the bottom of the pipe to 182° within 2 in. of the top and then drops to 130° at the top of the pipe. In view of such temperature and velocity ranges it requires engineering skill of the highest order to determine the number of heat units passing through a leader pipe from a furnace in a given time. It is necessary to do so in order to determine the furnace output in figuring the heat balance. There is no such delicate measuring or intricate engineering problems involved in testing either power or heating boilers. I wonder if your correspondent realized that there were "sech animals" to be mastered by the engineer before it were possible to discuss furnace design intelligently. I do not think so.

In spite of the inability of the engineer to furnish the furnace manufacturer with suitable instruments and standards for testing furnaces, we find the efficiency of the warm-air furnace compares favorably with that of the heating boiler.

The performance curves developed by Professor Willard and his research staff show a furnace efficiency of nearly 65% at a relatively high rate of combustion. The type of furnace tested is the ordinary competitive flat-bottom crescent-radiator type, the oldest and by no means the most efficient type.

To burn coke efficiently requires no special design of furnace. All that is necessary is to install a furnace having one or two sizes larger firepot than that required for hard coal. The same applies to boilers. It is a serious detriment and handicap to the proper pitch of leader pipes to increase the height of the furnace by increasing the depth of the firepot.

The contraptions placed on fire doors as suggested, may waste more coal because of excess air than they save. A large supply of air over the fire is required for only a few minutes after firing a fresh charge of coal. If this large air supply over the fire is constant an excessive waste results due to excess air passing through the heater as indicated by a low CO_2 reading. Government bulletins state that about 40% of the fuel waste of the country is due to this one factor of excess air, or low CO_2 reading.

It is thus seen, according to results obtained, that the furnace manufacturers have not only given considerable thought to the problem of furnace design, but have the honor of being the first association or body to finance and establish a Research Bureau to advance the science of heating and ventilating by developing new instruments of precision and establishing new standards for determining actual measurements of engineering phenomena, without which no real engineering knowledge is possible. It is to be hoped that other bodies besides the furnace manufacturers and the A. S. H. & V. E. will finance and establish other research bureaus. Our real knowledge of basic principles of engineering phenomena is very meager because of the lack of suitable research work.

Utica, N. Y. P. J. D.

Schedule for Steam and Water Heating Fixed by Illinois Commission.

The revised rate schedule for water and steam heating service in the City of Springfield, ordered filed by the Springfield Gas & Electric Company, requires the consumer to so arrange the piping in the premises to be heated that all condensation may be discharged to the meter or meters supplied by the company, the reading of which meters shall be accepted as a standard of measurement and charge under this rate. The fixed charge per square foot of required radiation per season was placed at 7.75 cents gross, one seventh of the total season's fixed charge being payable on the first of each month from October to April, with 10% discount if paid within 10 days. Steam consumed as registered on the condensation meter or meters to be paid for, in addition to the above fixed charge, at the rate of 45 cents gross per 1,000 lbs. of steam condensed. Water heating service rate per season per square foot of required radiation was fixed at 21% gross; for heating water in tanks (range boilers) by hot water service the charge was based on the capacity of the tank in accordance with a prescribed schedule. The rule prescribed for determining the square feet of radiation required to heat a building was as follows: Since the radiation in any room must emit sufficient heat to compensate for all heat losses from that room and since heat is transmitted by different building materials at different rates it follow that:

$$\text{Radiation required} = \frac{\text{B. T. U. lost per hour}}{\text{B. T. U. emitted per sq. ft. of radiation per hr.}}$$

Performance Curves as a Basis for Rating Boilers.

All the data needed by the trade in determining boiler ratings are contained in curves similar to that shown herewith, according to Frank B. Howell, director of the American Radiator Company's Department of Research. Mr. Howell made this statement at the recent annual meeting of the American Society of Heating and Ventilating Engineers, in Philadelphia, during the course of a discussion of boiler ratings.

"It would be a wise thing," he declared, "if the manufacturers of low-pressure sectional house heating boilers would adopt a standard method for rating boilers. It seems to me, however, that the heating engineer is much more interested in knowing exactly what a boiler will do at all percentages of its rating. If one were to buy a motor or a dynamo, the vendor of such apparatus would provide an economic chart which would define exactly what the motor or the generator would do. He does not go into the details of how many miles of wiring are contained in the motor, or the size of the wire, nor does he submit drawings showing the construction, but he provides an economic chart which is a certification of the performance of that piece of apparatus.

"If the manufacturer of low-pressure house heating boilers were to do the same thing, it might relieve the heating engineer of much uncertainty and conjecture in the selection of a boiler."

Mr. Howell then explained the chart, first stating that it does not make any difference how a manufacturer estimates a boiler's rating, provided he will show the outcome of the test in curves like those shown.

On the bottom of the chart is the catalogue rating in per cent., running from 10% to 150%.

"If you will follow along the bottom figures," continued Mr. Howell, "until you come to 100% of catalogue rating, then follow the vertical line upward, you will note that the first heavy horizontal bar indicates six hours without attention. The next bar indicates eight hours without attention. Note that the 100% rating line crosses the curve entitled, "Intervals in Hours Boiler Will Operate Without Attention," at the 8-hour mark. If a boiler will deliver 100% of its rating for eight hours without attention. It is prima facie evidence to the heating engineer that the fuel carrying capacity of that boiler is sufficient to operate continuously at that output for eight hours without attention.

"If you will follow that vertical ordinate to where it crosses the "Boiler Efficiency" line, you will see that when the boiler is operating at 100% of its rating for eight hours without attention, it is operating at an efficiency of between 70% and 80%. It appears to cross at about 75%.

"The boiler manufacturer is often requested to state what is the efficiency of his boiler and he either expresses it in evaporative power or in percentage. He may say 8 lbs. or 8½ lbs. or 9 lbs. of water, or he may say 75% or 80% efficiency, but he fails to state at what per cent. of the boiler's rating the efficiency was developed. You will notice that the efficiency curve changes with every output rate. When a boiler operates at 100% of its rating, it performs with an efficiency of 75%, approximately.

"If you will follow to the left of the chart, along the efficiency curve to, say, 60% of the boiler's rating, which is near the peak of the curve, you will see that it closely approaches 80% efficiency. We all know that the heating boiler is not called upon to give 100% of its rating all the time, but that for, perhaps, 80% of the winter, it drowses along between 40% and 60% of its load, paralleling the weather conditions. This valuable characteristic of the efficiency curve would enable the heating engineer to select a boiler that would render the greatest obtainable economy during all the winter. The heating engineer ought not to be compelled to ask the boiler manufacturer how many square feet of heating surface he has in his boiler or how many pounds of coal he considers a charge or how many pounds of reserve coal he has left after he has developed the boiler's rating for eight hours without attention."

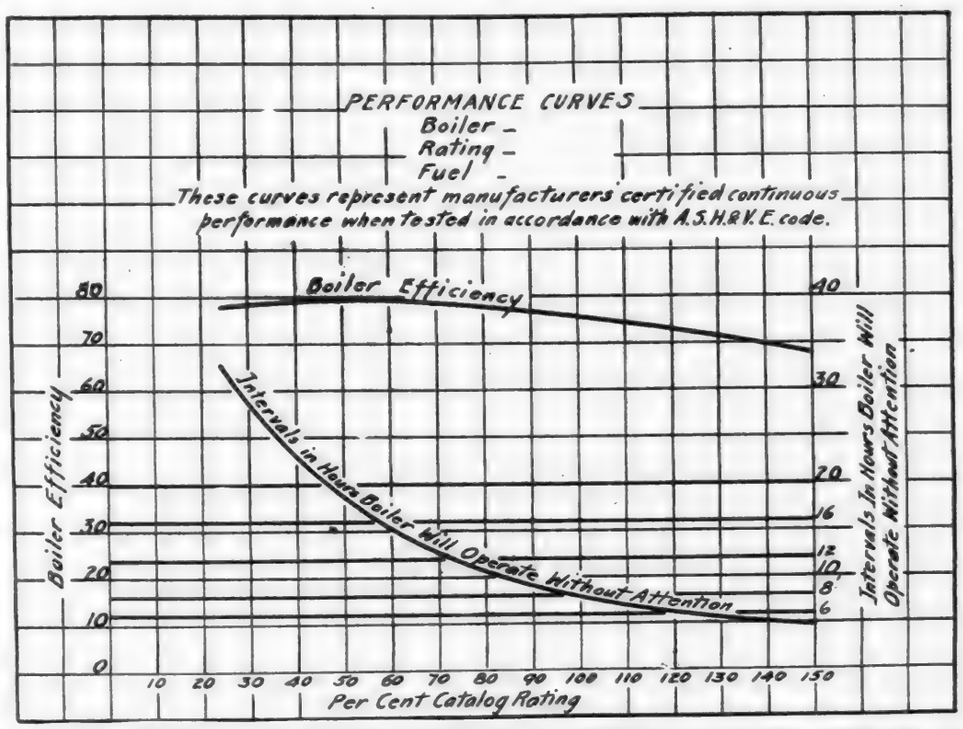
Mr. Howell emphasized the fact that the A. S. H. & V. E. boiler testing code was used in developing the performance curves, it being stated on the chart that "these curves represent manufacturers' certified continuous performance when tested in accordance with the A. S. H. & V. E. code." In this connection, however, he pointed out that the provision in the code, which allows up to 80% as available and 20% for rekindling fuel charge, does not provide for a satisfactory rekindling charge on small boilers when operating continuously. A fuel charge of such proportions makes it possible to develop a single 8-hour test splendidly, but at the end of the eight hours, Mr. Howell claimed, there will not be live fuel enough in the boiler to develop the rating for a second 8-hour period, because it will take a couple of hours to build the boiler up to rating again after recharging it. A chart like the one he exhibited, he stated, will disclose such shortcomings.

"If a boiler burns anthracite or bituminous coal and does not consume the volatile gases, it will certainly be reflected in the efficiency curve. If provisions have been made for burning the volatile, it will show in the efficiency curve. If a boiler manufacturer has made his boiler skimpy so that it will not run eight hours and then run another eight hours continuously, it will show in the 'interval' curve. There have been made what manufacturers know as 6-hour boilers that will do their work continuously and properly for six hours, but they will not develop their rating for eight hours, because they haven't sufficient fuel-carrying capacity. No ratings should be established on any heating boiler, small or large, based on a short time test. The test duration should cover several firing and several shaking and fire-cleaning periods."

In concluding Mr. Howell pointed out one other important feature of the chart. "If a manufacturer," he said, "records a performance of a 6-hour boiler on a chart like the one before us, the curve 'Interval of Hours Boiler Will Operate Without Attention' will not be where this one is, but it will cross the 100% of rating at six hours. And the heating engineer will know automatically that it is a six-hour boiler."

Heating Contractors to Meet in Boston.

The annual convention of the Heating and Piping Contractors' National Association, it is announced, will be held in Boston, May 31 to June 3, 1921.



BOILER PERFORMANCE CURVES SUGGESTED BY AMERICAN RADIATOR COMPANY AS BASIS FOR RATING BOILERS.

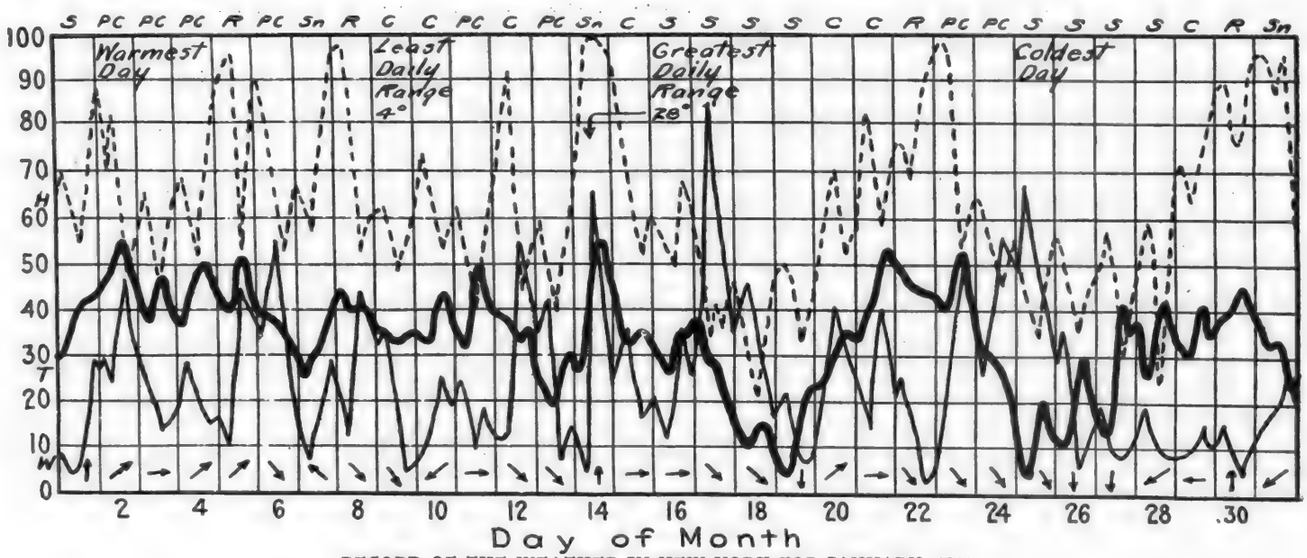
Library Planned for St. Louis Heating Engineers.

The February meeting of the St. Louis Chapter was called to order on the evening of February 10 after an excellent dinner at the American Annex. Following several routine matters there was presented the plan for starting an engineering library for the benefit of chapter members. It was proposed to take up a collection among the members for this purpose and the suggestion was well received.

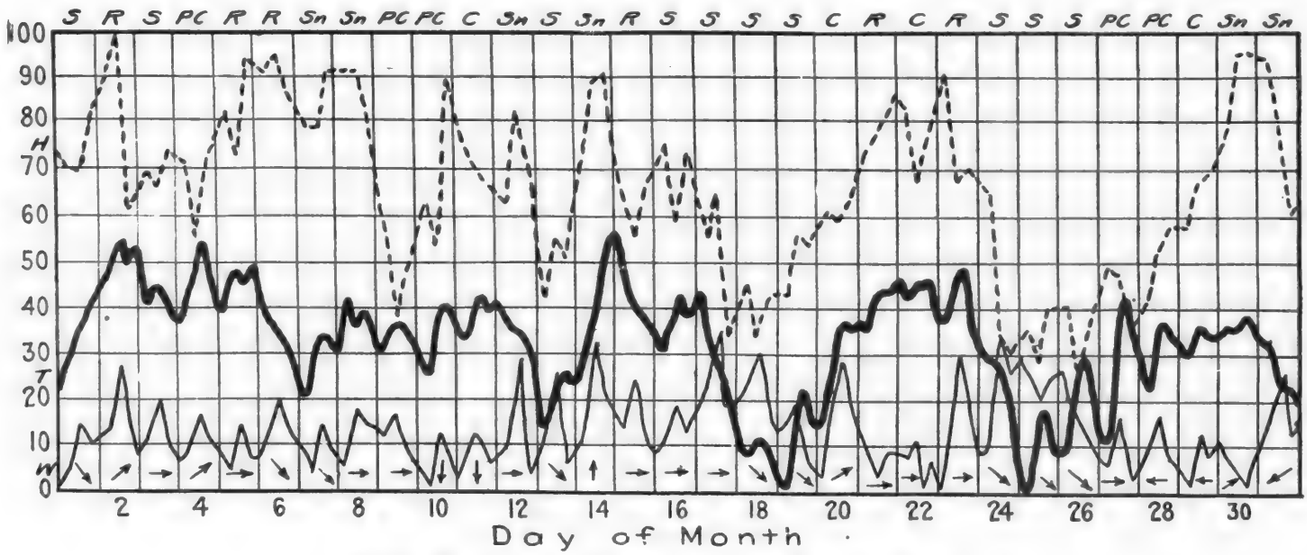
Echoes of the Philadelphia meeting were heard in talks by E. S. Hallett and Walter A. Klein, which were followed by technical discussion on the proper size of chimneys. The principal paper of the evening was then presented by O. W. Adams on the history of the air valve. According to Mr. Adams the history of the air valve is really a history of steam heating since all improvements in steam heating have really been due to improved methods of removing air from the system. The opinion was expressed by the speaker that air valves are now obtainable which represent almost perfection in this matter and which can be relied upon to vent continuously.

THE WEATHER FOR JANUARY, 1921

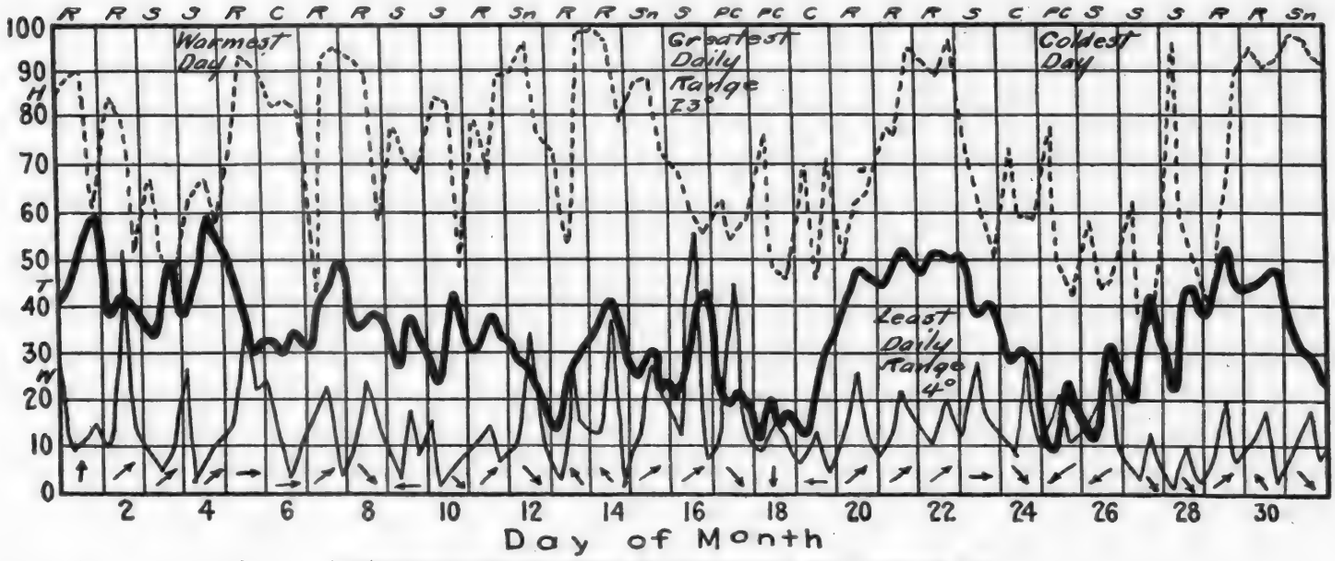
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	55	56	59	56	67
Date of highest temperature	2	14	4	21	21
Lowest temperature, degrees F.	4	0	9	8	12
Date of lowest temperature	25	25	25	17	17
Greatest daily range, degrees F.	28	32	23	22	24
Date of greatest daily range	14	14	16	19	7
Least daily range, degrees F.	4	5	4	4	4
Date of least daily range	9	30	22	31	13
Mean temp. for month, degrees F.	33.6	32.1	34.6	32.4	39.2
Normal mean temp. for month, deg. F.	30.2	27.0	30.7	23.7	30.8
Total rainfall, in.	1.65	2.24	3.35	0.97	1.10
Total snowfall, in.	2.6	3.6	2.4	3.2	2.2
Normal precipitation, this month, in.	3.79	3.82	2.87	2.00	2.27
Total wind movement, miles	15555	8559	9114	10152	10816
Average hourly wind velocity, miles	20.9	11.5	12.2	13.6	14.5
Prevailing direction of wind	N. W.	W.	S. W.	W.	S.
Number of clear days	9	10	9	12	14
Number of partly cloudy days	8	5	5	5	4
Number of days on which rain fell	4	6	16	5	5
Number of days on which snow fell	3	6	3	7	2
Snow on ground at end of month, in.	0.5	0.4	1.8	2.0	None



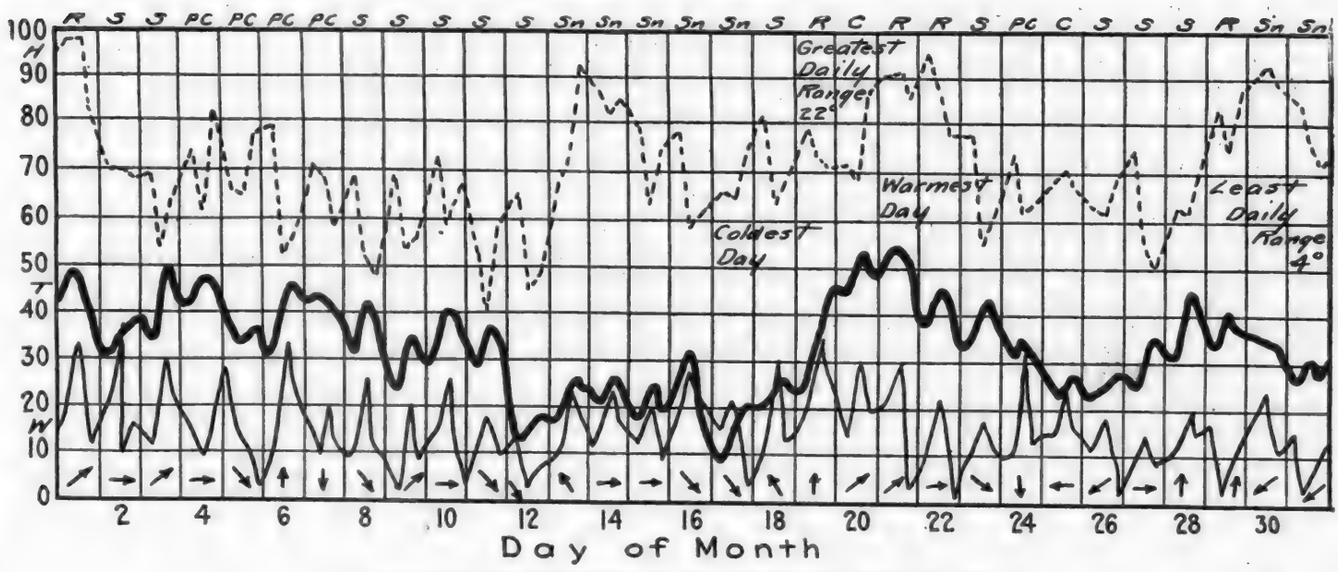
RECORD OF THE WEATHER IN NEW YORK FOR JANUARY, 1921.
(Hourly Observations of Relative Humidity Plotted on this Chart.)



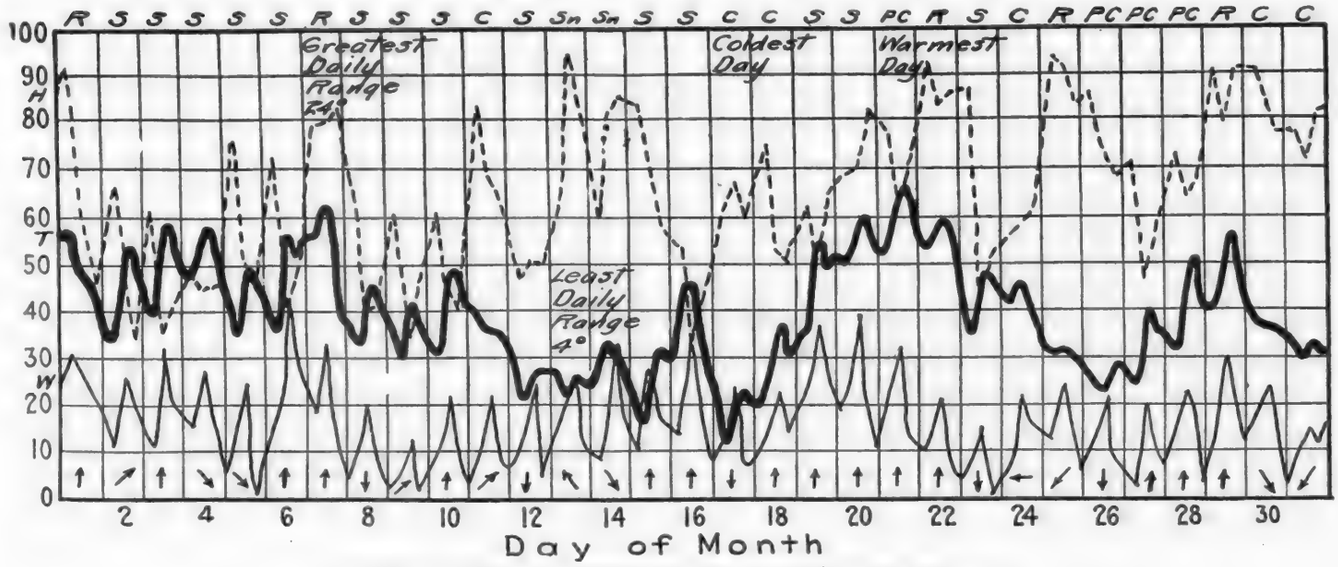
RECORD OF THE WEATHER IN BOSTON FOR JANUARY, 1921.



RECORD OF THE WEATHER IN PITTSBURGH FOR JANUARY, 1921.



RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1921.



RECORD OF THE WEATHER IN CHICAGO FOR JANUARY, 1921.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings taken at 8 A. M., 12 M., and 8 P. M.
S-clear, P C—partly cloudy, C—cloudy, R—rain, Sn—Snow.
Arrows fly with prevailing direction of wind.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Hot Water Versus Steam for Heating Discussed by the Illinois Chapter.

The Illinois Chapter held its monthly meeting at the Chicago Engineers' Club on February 14, at which time five new applications for membership were approved. Echoes of the recent salubrious occasion in Philadelphia brought forth congratulations for the Eastern Pennsylvania Chapter. A vote on the choice of the chapter regarding a summer meeting place, gave Cleveland a slight edge on Duluth for this event.

C. B. Barnes and O. C. Spurling, both of the Western Electric Company, presented papers discussing the comparative merits of steam and water heating. Mr. Spurling gave figures on first cost and operating cost of steam and of water heating as applied to his plant. He estimated that there was a net, saving of $33,000 per annum in favor of the water heating, due to saving in coal. This saving he explained as resulting from the fact that the average winter for temperature of Chicago is about 37° F. He considered that steam and water heating are about equal in cost at an average winter temperature of zero, but that water heating is more economical in milder weather.

The opposite side of the question was taken in a paper by John D. Small, consulting engineer, which discussed heating for various types of buildings. The types of buildings were classified and steam was recommended for most of these classifications. A lively discussion was precipitated by these papers, drawing in a number of the members and guests present.

Kansas City Chapter Hears About Value of Industrial Self-Regulation.

At the monthly meeting of the Kansas City Chapter on February 4, the value of organized activities within an industry in the direction of self-analysis and self-regulation, was urged in an address by J. E. Templeton, President of the Western Central Association of Stove Manufacturers. Mr. Templeton expressed the opinion that the determining of costs of doing business is a legitimate function of trade organizations. He believes that many present day problems can be solved by organized effort.

An address by E. D. Hornbrook, past president of the National Association of Master Plumbers, supplemented the plea by Mr. Templeton for co-operation in industry. Mr. Hornbrook told of the work of the Trade Extension Bureau which is a step in this direction recently initiated by the plumbing trade.

Non-Technical Meeting Held by the Western New York Chapter.

Inauguration of L. A. Harding as president of the chapter was the first feature of the meeting of the Western New York Chapter at the Hotel Iroquois, Buffalo, on February 7. Mr. Harding was the first president of this chapter and his re-election was a tribute to the interest and activity which he has shown in the affairs of the chapter and of the society as a whole. A brief outline of the plans for the coming year was given in the president's address.

Secretary Obert next gave an interesting story of the growth of the society. His talk took into consideration the work being accomplished and laid great stress upon the formation and continuation of the Department of Research at the Bureau of Mines in Pittsburgh.

The third speaker was Dean Scipio of the Department of Research. The Dean spoke of the years he had spent in Constantinople as the head of Roberts College in that city, and his close relationship with the Constantinople College for Girls. He gave a very excellent description of the methods of heating employed in Turkey starting with the primitive stoves and advancing step by step to the modern heating methods used in the large colleges spoken of, the heating installations in these buildings being installed entirely according to American plans and using American product. It was of interest to our society members to know that they offered to pay from $40 to $60 a ton for coal to use in heating these buildings. Therefore the heating system had to be most economical and one can appreciate that every precaution was taken to make these plants efficient. Mr. Scipio's address was entirely new and left the impression that the good work he has accomplished overseas, will be multiplied many times in his laboratory at the Department of Research.

Comparison of Coal and Oil Fuels Featured at the New York Chapter Meeting.

Staged at the Building Trades Club on February 14, the perennial conflict between coal and oil, or in the words of one speaker "the old and the new methods," blossomed again under the the revivifying influence of a first class dinner. The dinner was so good, in fact, that immediately following it a vote on the preference of the chapter as to the summer meeting place resulted in a tie between Duluth and Cleveland, each city receiving two votes. The opinion of the members will be canvassed by mail.

President Fleisher introduced as the first speaker of the evening, David Moffat Myers, formerly advisory engineer with the U. S. Fuel Administration, who spoke on the close relation between heating and power requirements in the determination of equipment and operating methods in any special installation. Mr. Myers's paper touched on both the technical and the economic phases of the fuel problem and showed how the ability to utilize exhaust steam for heating and process work greatly increases the efficiency of a power plant. He spoke of the super-power survey and of the limitations of possible economies to be secured along this line. As an additional and supplementary means to greater economy of fuel, he suggested the advisability of a large scale survey of the wastes of heat involved in the operation of big electric light and power stations with a view to more general utilization in industry and for central heating of office buildings and residences. Water power was excluded as a large addition to the energy supply sources of the nation since, according to his figures, most of the nation's water power is west of the Rockies while most of its power requirements are located east of the Mississippi.

The second paper of the evening was read by L. H. Morrison, of "power," who presented statistics indicating probability of an early depletion of the oil resources of the nation now known and economically possible. Mr. Morrison had classified the annual requirements of oil for gasoline, lubricant production, merchant marine and navy bunkering, boiler operation and other uses, and his estimate gave a large percentage of the present annual production to preferred services so that in his opinion there was very little chance of an increase in amount of oil fuel available for use under boilers.

The fortunes of oil fuel seemed to be distinctly at ebb tide when Mr. Morrison concluded but a few minutes later the audience was inundated by a tidal wave of oil from California and Colorado. W. C. McTarnahan, admitting

California as his native state, refused to allow his individual horizon to be clouded by the phantom of oil depletion. He has seen the oil flowing out of the ground in his native state and also the millions of acres of oil shale in Colorado and faces the future with confidence that the oil gushers will continue to be discovered and that the economy of shale recovery will be greatly increased as time passes, so that it will be possible to burn oil under boilers long after the fourteen years allowed by Mr. Morrison before the oil resources of the nation are exhausted. Space will not permit a reprint of the story told by Mr. McTarnahan to illustrate the superiority of new over old methods.

At a meeting of the Board of Governors of the New York Chapter, after the technical meeting, the following members were appointed as a nominating committee for the selection of chapter officers for the coming year: Arthur Ritter, chairman; J. A. Donnelly; J. I. Lyle; W. S. Timmis; and Perry West.

PRESENT STATE OF THE ART IN SMOKELESS BOILER CONSTRUCTION

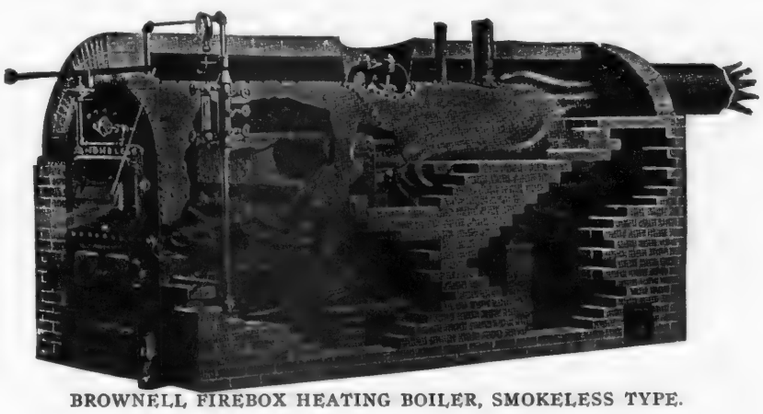
No. 22—Brownell Firebox Heating Boiler, Smokeless Type.

Among the brick-set boilers is that manufactured by the Brownell Company, Dayton, Ohio, and illustrated in section by the accompanying view. Using the popular Hawley down-draft principle, the upper grate in this boiler is distinguished from the ordinary design by the absence of a front grate header, the hollow grate bars being expanded into the water-jacketed front of the boiler casing. The rear header supports a curtain wall of fire-brick and at the rear of the lower grate an inclined parapet directs the fire travel up into the horizontal fire tubes.

The return passage instead of going through tubes is around the outside of the boiler shell, lower portion, through the ample combustion chamber provided by the brick setting. The final passage from front to exhaust flue at the rear carries the hot gases along the upper portion of the boiler shell exterior.

A water-jacketed steel casing encloses the fire-box of the Brownell boiler adding a considerable area of direct heating surface to that provided by the tubes and shell exterior. The lower grate is of the rocking type usual to this class of boiler, with sufficient angle of rotation so that they can be dumped when desired. The rear extension of the boiler shell rests upon a roller bearing which allows of expansion and contraction of the shell without structural displacement.

The same general features of this smokeless boiler are embodied in a smokeless furnace manufactured by this company for use with horizontal return tubular boilers.



BROWNELL FIREBOX HEATING BOILER, SMOKELESS TYPE.

No. 23—Peerless Down-Draft Smokeless Boiler.

The built up cast-iron sectional type of construction is used in the Peerless down-draft smokeless boiler, manufactured by the Peerless Heater Company, Pittsburgh, Pa. The accompanying illustration shows both the structural features and the method of operation of this boiler. A single large central header at the top, cast integral with the sections, serves as the supply reservoir, while smaller headers, one on each side of the boiler near the bottom, provide the required water inlet.

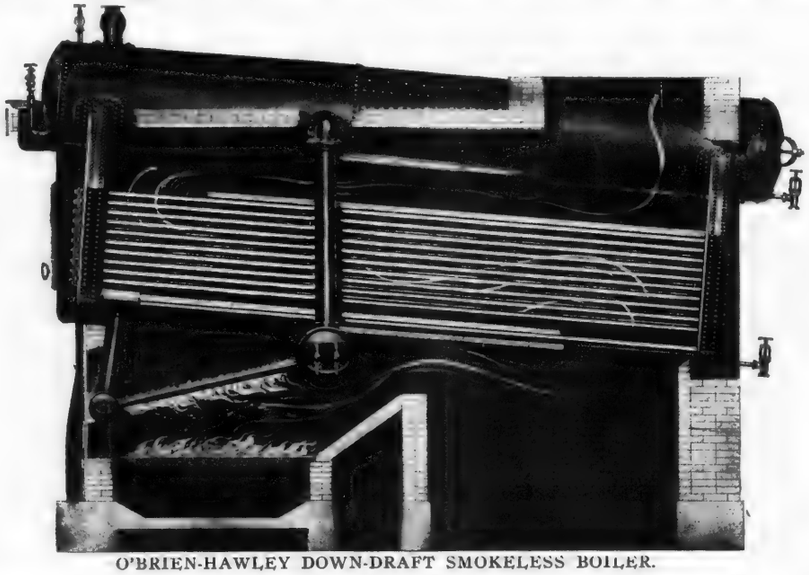
In this sectional view is shown the position of the water-grate (which is also cast integral with the sections), heating surfaces, combustion chambers, and lengthy boiler flues which combine to bring about smokeless operation of this boiler with soft coal fuel. In addition to these features, it is worthy of note that this manufacturer uses a patented S-arm brace, placed one at each end of each hollow grate section. The particular virtue claimed for this construction is that it further splits up the water stream, adding direct heating surface at the most effective point, which aids in quick generation of steam.

PEERLESS DOWN-DRAFT SMOKELESS BOILER.

Two other structural features of the Peerless boiler are the cup-shaped arches in the crown plate and boiler flues, and the V-shaped section of the side walls, both of which aid in the production of eddies and desirable agitation of the heated gases. The manufacturer cites an instance of actual test on a ten-section boiler where there were 8.65 lbs. of water fed per pound of coal fired, 8.75 lbs. of water evaporated per pound of dry coal, and where there was obtained an equivalent evaporation, from and at 212° F., of 10.2 lbs. of water per pound of dry coal. Assuming 14585 B. T. U. per pound of dry coal, this gave a combined efficiency of 67.9% for the boiler, furnace, and grate.

No. 24—O'Brien-Hawley Down-Draft Smokeless Boiler.

The accompanying sectional view shows an extension type O'Brien-Hawley down-draft furnace applied to a O'Brien water tube boiler with vertical baffle, the combination being manufactured by the John O'Brien Boiler Works Company, St. Louis, Mo. This combination is intended primarily for high pressure power service but the same style of furnace is applicable to heating boilers where it is desired to secure smokeless operation on bituminous fuel. The illustration is largely self-explanatory. The upper grate is set at a pronounced angle in order to secure improved draft. This water tube grate is made in two styles, a double or staggered design with alternate tubes set on upper and lower rows, and a design where all the tubes are set in a single row. The latter construction is recommended.



O'BRIEN-HAWLEY DOWN-DRAFT SMOKELESS BOILER.

It is worthy of note that M. C. Hawley, inventor of the down-draft principle of furnace operation, was associated with the above concern for twenty-one years prior to his retirement in 1909. In 1888 this company attached the first down-draft furnace ever made to a 60 in. by 20 ft. tubular boiler with eighteen 6-in. flues. The operating characteristics of the combination were found so far superior to the same type of boiler with an ordinary grate that an order for a second down-draft furnace was secured at once and the effectiveness of the down-draft principle was quickly recognized in the industry.

No. 25—Reck Universal Boiler.

The course of procedure in design of any piece of apparatus is always influenced by the conditions under which the apparatus is to operate. It follows then that what would appear to be an economical design from the standpoint of one set of conditions might not necessarily prove economical under a different set of conditions. A question of this kind is raised by the present movement aiming at the introduction into this country of a new form of low-pressure boiler for heating service which has been tried out thoroughly and has proved successful under conditions differing somewhat from those obtaining in the United States.

Reference is made to the Reck universal boiler, manufactured by the Reck Heating Company, Ltd., of Copenhagen, Denmark. This boiler, as at present put out, is the result of about sixteen years' experience under Scandinavian conditions of very high cost of fuel and maintenance. Under these conditions it has been necessary to concentrate particularly on fuel economy and reduction of the amount of attendance required to secure efficient operation. The first of these conditions is not nearly as severe in this country while the second is very closely approximated. It will be a matter of interest to observe whether or not this boiler shall prove able to compete commercially with boilers of domestic design intended for the same service.

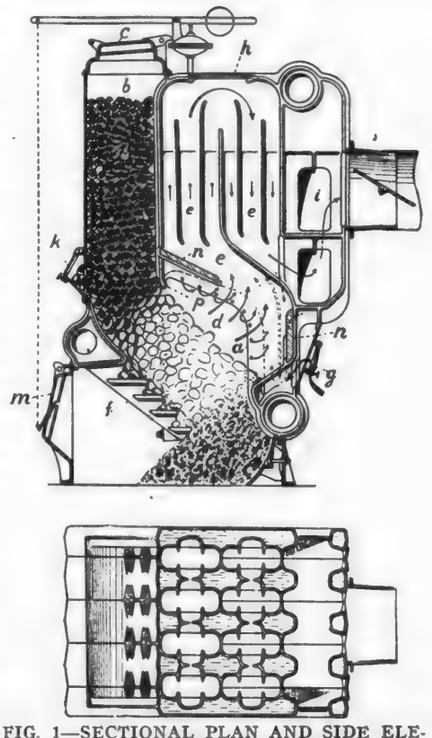


FIG. 1—SECTIONAL PLAN AND SIDE ELEVATION OF RECK UNIVERSAL BOILER.

The most important feature of the latest type of the Reck universal boiler is the means of introducing the supplementary, secondary air. Each section of the boiler is provided with an air canal, located on the edge towards the combustion chamber, as shown in Fig. 1. The air leaves the canals—through two opposite rows of close set openings—in the form of jets, striking the combustible gases, liberated from the surface of the fuel bed, just as they are to enter the smoke flues, which are located between the boiler sections. This intermixing shower of fresh oxygen, evenly distributed over the whole surface of the fuel bed, is sufficiently far from the surface itself to avoid doing work as primary air and must necessarily result in a most intimate mixture of gases and air, causing an immediate and complete combustion of the gases. This, in turn, will mean a negligible loss due to unburned gases.

The boiler is so designed that the greater part of the fuel magazine is outside the boiler proper, it being an easy matter to alter the size of the magazine. As illustrated in Fig. 3 the magazine holds a quantity of ordinary soft coal sufficient to leave an ample rekindling reserve after 8 hours of continuous run without intervening refilling. If it is desired to run the boiler 8 hours with very

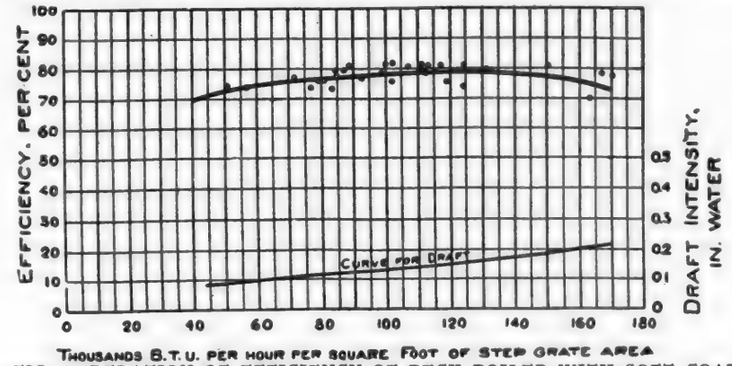


FIG. 2—RELATION OF EFFICIENCY OF RECK BOILER WITH SOFT COAL TO HEAT UNITS DEVELOPED PER HOUR PER SQUARE FOOT OF STEP GRATE AREA.

bulky fuel, it is a simple matter to provide the boiler with a magazine of the necessary size. Due consideration has been given in the design to the elimination of stresses caused by expansion of the cast sections.

Grate bars and grate bar supports are water-cooled so as to prevent destruction of these parts from intermittent overheating, which otherwise would occur when the primary air is being shut off by the closing of the boiler front damper. The step grate, with its slanting position in relation to the fuel magazine, permits of the ashes and slag passing on automatically to the ash-pit with the downward movement of the fuel along the grate, eliminating entirely any attention of the firemen except the ordinary grate cleaning, once a day with soft coal. The primary air will therefore find an unobstructed passage through the fuel bed, and as the latter furthermore is automatically maintained at a constant thickness, the boiler is capable of

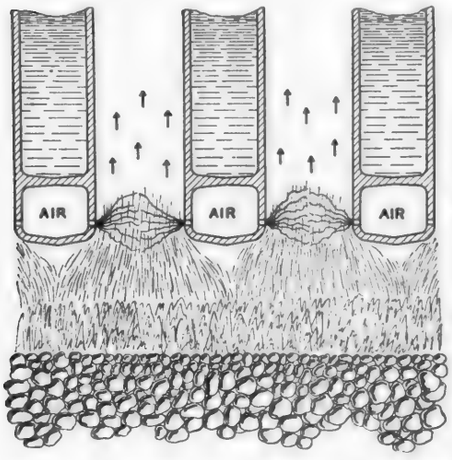


FIG. 3—METHOD OF SUPPLYING AIR TO COMPLETE COMBUSTION IN RECK UNIVERSAL BOILER.

being worked a whole day at its full capacity without requiring any attention whatever.

As its name implies, the Reck universal boiler is independent as to kind and quality of fuel, allowing the user to employ economically, even with low chimneys, whatever fuel is cheapest or easiest obtained in his locality, be it lignite, bituminous coal, briquets, coke or anthracite, without screenings, and preferably averaging sizes between ¾ and 3 in. Fuels of sizes less than ¾ in. may be used, especially anthracite if well screened, and if the boiler is of ample size. Bituminous coal must be non-coking in order to avoid sticking to the grate instead of sliding down, when the lower portion of burning fuel has been consumed.

The Reck boiler can be worked at a high rate of combustion without the efficiency being materially lowered. In other words, it is possible to secure the regular room temperature in a house early in the morning on a very cold day, even if the boiler damper has been kept practically closed during the previous night. The diagram in Fig. 2 shows the relation between efficiency and rate of combustion of soft coal, when the consumption varies from 40,000 to 170,000 B. T. U. per hour per sq. ft. of step grate area. The curve is plotted from results of a number of actual tests and shows there is remarkably constant efficient within the limits of ordinary practice. With the large free grate area characteristic for the step grate used, the quantity of fuel that can be burned per square foot of the grate, is twice as much as can be burned on an ordinary grate.

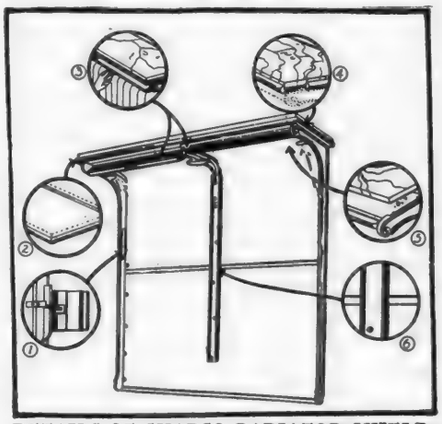
Tests were conducted on this boiler by Professor H. Bache, director of the mechanical laboratory at the Copenhagen Polytechnic Institute, to determine the influence upon boiler economy of continuous firing with highly volatile fuel without intervening cleaning. The results of these tests were given in a paper by Captain A. B. Reek, presented at the annual meeting of the American Society of Heating and Ventilating Engineers in January of this year. Summarizing these results briefly, they may be stated to indicate that with this type of boiler there was found, under practical operating conditions, very little drop in the efficiency due to continuous operation on bituminous fuel of high volatile content for a period of two weeks without cleaning. In order to verify these results under conditions in this country, a boiler of this design is being subjected to similar tests at the Drexel Institute laboratories in Philadelphia, and will subsequently be taken to the heating engineers' Research Laboratory in Pittsburgh for the same purpose. In later issues it is planned to present material showing the findings of these tests.

New Apparatus and Appliances

Shapco Radiator Shield.

Several novel features are shown in the Shapco radiator shield recently patented by the Sodeman Heat & Power Company, of St. Louis, Mo., a view of which is shown herewith. This shield covers the entire top and back of the radiator and protects the walls, tapestry and hangings of the room from dust and dirt. A patented dust trap is placed inconspicuously under the top of the shield to catch and retain the dust and soot which tends to be circulated by the air currents created by the radiator. This dust trap is arranged so as to be easily cleaned. The tops are furnished in metal, plate glass, or marble with cretonne, damask, or bricade inserts to harmonize with the room furnishings.

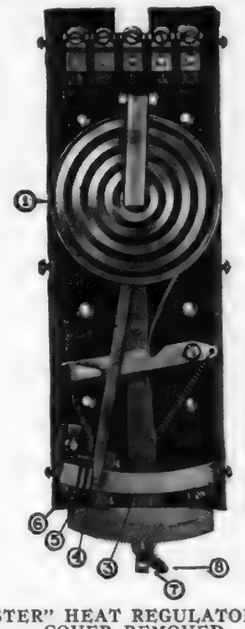
Other features of this shield are a truss construction which ensures rigidity, a projecting tooth at each end of the top which engages the end sections of the radiator and prevents lateral motion of the shield, and a center bracket or supporting rib which also adds to the rigidity of the device. The whole shield is securely clamped to the radiator and becomes virtually part of it.



DETAILS OF SHAPCO RADIATOR SHIELD

"Master" Heat Regulator.

A heat regulator with certain unique features is now being marketed by the Master Heat Regulator Company, St. Paul, Min. As shown in the accompanying sectional view, this regulator operates on the diaphram thermostat principle, the movement of the lever arm actuating an electric motor which



"MASTER" HEAT REGULATOR WITH COVER REMOVED.

in turn operates the draft and check dampers simultaneously. It is distinguished from other devices of the kind by the fact that there are four motor control positions, corresponding to the draft damper positions of closed, one-third, two-thirds, and full open. This complete range of positions corresponds, according to the manufacturer's prospectus, to a temperature range from normal to 2° F. below normal. Normal point can be set to suit

the installation requirements. The apparatus complete includes, with the thermostat unit a clock and thermometer mounted on the outside of the thermostat case, and a motor unit with its supporting bracket, together with the minor accessories. The device operates on either dry cells, a farm lighting circuit, or (using a "Master" transformer) on an alternating current line. It is claimed that one set of dry cells will operate the regulator throughout an entire heating season. The further claims of the manufacturer are that this oufit will give positive results on small variations of temperature and will give these results constantly, also that by reason of the four control positions the regulation is closer than in other types.

Thompson Du Moin Return Line Vacuum Pump.

The Thompson Manufacturing Company, of Des Moines, Iowa, has secured patents on a new form of apparatus which is being marketed as the Thompson Du Moin return line vacuum pump, although it has functions considerably broader than the term "pump" usually designates. The apparatus is designed particularly for service on vacuum heating systems and represents certain features novel to that service. In this design the manufacturers have eliminated stuffing boxes, air vents, belts, gears, and the necessity of handling the liquid through the pump.

In the unit shown in the accompanying illustration, the pump handles air only. There is provided in this unit a method of removing air and condensation water from the return pipes of the heating system, discharging air to the atmosphere and the condensation water back to the boiler.

This pump operates in the above process first as a vacuum pump and then as a pressure pump. When the tank is empty it works as a vacuum pump, drawing air from the tank and returns. As soon as the tank fills the float operates reversing valves which change it to a pressure pump. Air is then drawn from the atmosphere, putting a pressure in the tank which forces the condensation to the boiler. At the end of this process (when the tank is again empty) the valves are again reversed and the cycle proceeds in the same manner.

The complete unit consists of a separating tank, a direct connected pump and motor, an electric cabinet containing self-starter and protective time-limit fuse, check valves on the suction and discharge connections, a vacuum controller switch, and a float level switch. Each unit is assembled both electrically and mechanically and tested out thoroughly before shipment. All that the contractor has to do is to bring the service wires to the cabinet and connect the return pipes to the unit and the discharge pipe to the boiler. The special claims for the unit are simplicity, efficiency and reliability.

Since the air from the heatng system is discharged to the atmosphere rather than back against the boiler pressure, and because of the high efficiency of the rotary pump, this unit uses less than half the power required by other pumps, according to the manufacturer's statement. To be specific the unit is claimed to require only a ½ H. P. motor to handle 8000 sq. ft. of direct radiation when used with equipment where the discharge pressure at the pump is not greater than 10 lbs. per sq. in. The unit operates as a vacuum pump during the greater part of the time.

"Ozone Pure-Airifier."

An ozonator of new design has been recently put out by the Ozone Pure Airifier Company, Chicago, Ill., as a fuel saving device. This saving is based upon the difference in temperature between the outside air and the used interior air, which can be recirculated after ozonation with considerably less addition of heat.

Two views of the apparatus are shown herewith. Fig. 1 shows an assembly of twenty-five units with a combined capacity of 25,000 cu. ft. of air per minute. The units are mounted on an angle-iron frame of rugged construction which carries also the switch, control rheostat (by which the degree of ozonation is regulated), two fuses, and a step-up transformer by which the necessary high voltage is secured. The units are mounted on aluminum angles fastened to the angle-iron frame by suitable insulators. All the conducting wires are made of aluminum.

The object in the design of this ozonator was to secure a static discharge instead of an electric spark thereby eliminating the formation of nitrous oxide. The individual unit, as shown in Fig. 2, is constructed with this object in view. It consists of a smooth interior electrode of aluminum foil which slips snugly into a cylinder of Pyrex glass that forms the dielectric. The exterior electrode consists of a sheet of aluminum expanded to form a number of small points. This sheet is then bent to a semi-circular section with the points in and when in position these points rest against the outside of the glass cylinder. The discharge from this apparatus is claimed to be a continuous faint glow, rather than a series of crackling sparks. A simple clamping device allows the quick dis-

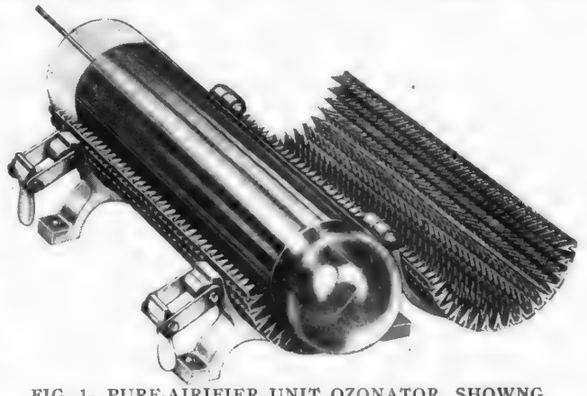
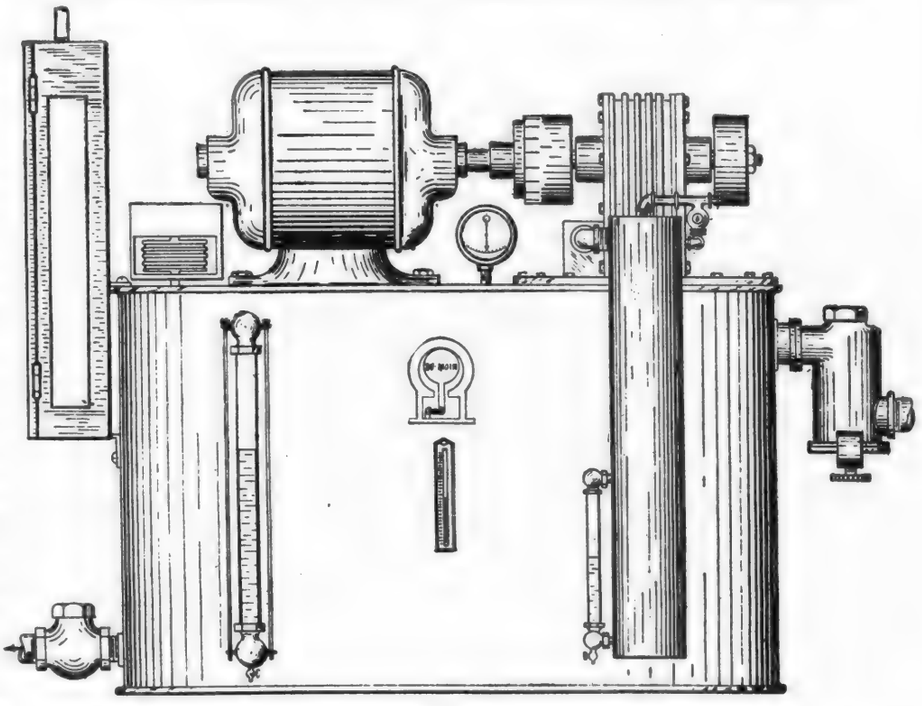


FIG. 1—PURE-AIRIFIER UNIT OZONATOR, SHOWNG CONSTRUCTION



THOMPSON DU MOIN RETURN LINE VACUUM PUMP, RECENTLY PLACED ON THE MARKET.

assembling of any unit for the purpose of cleaning or replacing any part.

The manufacturer's estimate of power consumption for the 25-unit outfit, operating at full capacity, is 120 watts, so that, according to this figure, the operating cost of a twelve-hour run at 10c per kilowatt-hour would come to 12 cents.

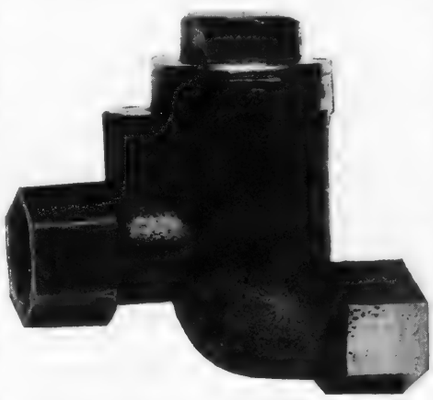
FIG. 2—25-UNIT ASSEMBLY, PURE-AIRFIER OZONATOR, CAPACITY 25,000 CU. FT. PER MINUTE.

New Vacuum Water-Seal Valve.

A number of new ideas are embodied in the vacuum water-seal valve, here shown, which has been designed and patented by John H. Lindsay, assistant to Frank G. McCann, chief of the Heating and Ventilating Division of the New York City Department of Education. Considerable ingenuity is shown in the means provided for raising or adjusting the interior without opening the top of the valve chamber. It will be noticed that the cap is separate and distinct so that its removal does not interfere with the system in any way. With the cap off, the disc carrying the post may be adjusted to any extent desired, it being possible to raise it sufficiently to permit any accumulated scale and condensation to be driven out and to relieve the pressure in the radiator into the return pipe without opening the top of the valve chamber. Hence, cleaning out, adjustment or repairs can be made without danger to the person or damage to surrounding objects, as sometimes occurs when vacuum valves are opened for cleaning or repairs.

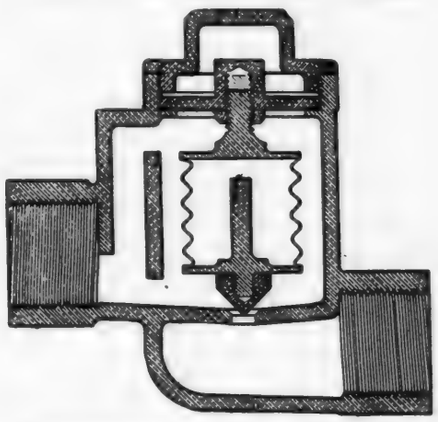
The operation of the valve, as will be readily seen, is by the expansion and contraction of a corrugated post, Mr. Lindsay having a patent on such a post dated as far back as 1893. By means of a baffle plate and by-pass in the valve body, the condensation and steam are controlled in a manner radically different from the action of valves now in common use, and on these original methods claims have been established. The valve has been subjected to various severe practical tests and in operation the following advantages have been demonstrated:

The valve has been found to be self-cleaning. Part of the condensation has to pass through the by-pass, over the top of the interior dam, thus washing out all parts of the valve. It has a graduated opening in that the contracted area of the inlet compels the excess water to flow through the by-pass and thereby cools the post and causes it to open the valve in exact proportion to the amount of condensation to be passed. It also has a graduated closing, since the steam follows the water through the by-pass and acts upon the upper portion of the post from the top downward as the water recedes, thus gradually closing the valve to suit the flow, until low-water line is reached, when quick and positive closing occurs.



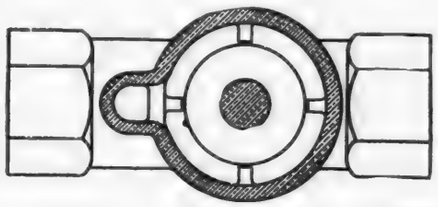
NEW VACUUM WATER-SEAL VALVE.

In normal operation a water-seal is formed by the baffle of the by-pass,



CROSS-SECTION OF NEW VACUUM WATER-SEAL VALVE SHOWING BAFFLE PLATE AND BY-PASS.

thus preventing escape of steam. The safety point has already been referred to and is intended to remedy a long-standing difficulty in clearing a radiator trap of grit or other obstruction without interfering with the heating system itself.



HORIZONTAL CROSS-SECTION OF NEW VACUUM WATER-SEAL VALVE.

This valve was patented September 21, 1920, by Mr. Lindsay (No. 1,353,767).

"Consulting Engineer" in Chinese.

Engaging in the consulting engineering business in China is no light matter, as shown by the letter-head of an American heating and ventilating engineer, Harold L. Alt, now practicing in Shanghai. His letter-head, which is reproduced herewith, looks simple enough to an unsophisticated American, but to a Chinaman it is an entirely different matter.

In order to make his profession known to his Chinese clients, Mr. Alt added the Chinese equivalents to his name and profession, the former at the right and the latter at the left of the letter-head. The characters at the right, reading down, are pronounced "Ah," "Uhl" and "Duh." If these are spoken quickly they sound something like Aldt, which is the nearest one can come to "Alt" in the Chinese language.

The five characters on the left-hand side, also reading down, mean literally "Head," "Ask," "Work," "Know," and "Person," which is the Chinese way of

TEL. CENT 1195

顧問工程師 HAROLD L. ALT 華爾德
CONSULTING ENGINEER
37B CANTON ROAD,
SHANGHAI
CHINA.

expressing "Consulting Engineer" and comes from their idea of the head or leading man to whom inquiries should be addressed and who knows what to say in response to inquiries.

New Publications.

ONE REGISTER FURNACES (Pipeless Furnaces) by A. M. Daniels is the title of Farmers' Bulletin 1174 of the United States Department of Agriculture, issued from the Government Printing Office, Washington, D. C. The subject is treated in a strictly non-technical manner and is well illustrated. Subject headings are, as follows: Principle of the system, construction of the furnace, circulation of air, factors affecting its suitability, limitations of the one-register furnace, means of heating a detached room, and advantages of the one-register furnace. The author is assistant mechanical engineer in the division of rural engineering.

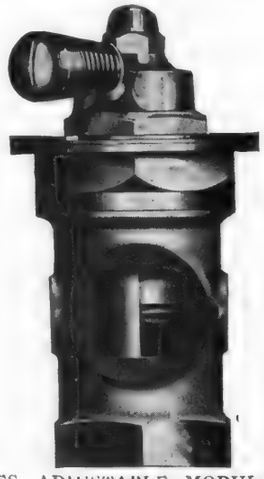
Trade Literature.

FAR OPERATIVE VALVES are described in a folder recently issued by the Far Operative Valve Co., New York. This valve is intended for use by customers of central heating companies and is installed between the steam inlet and the customer's meter. A plunger, actuated by an electro-magnet, operates a ratchet mechanism by which the valve is alternately closed and opened. The magnet is connected to the lighting circuit and operated by means of a push button switch located to suit the customer's convenience. On this switch there is mounted also an electrically operated indicator to show the position of the valve at all times. Sixteen impulses are required to either open or close the valve so that there is no danger of sudden opening or closing with this device. The valve proper is of the sliding type manufactured by the Everlasting Valve Co. Economy plus convenience is the claim for the "Far Operative" valve in this folder. Size 8 x 11 in. Pp. 4.

FAR-OPERATIVE VALVE.

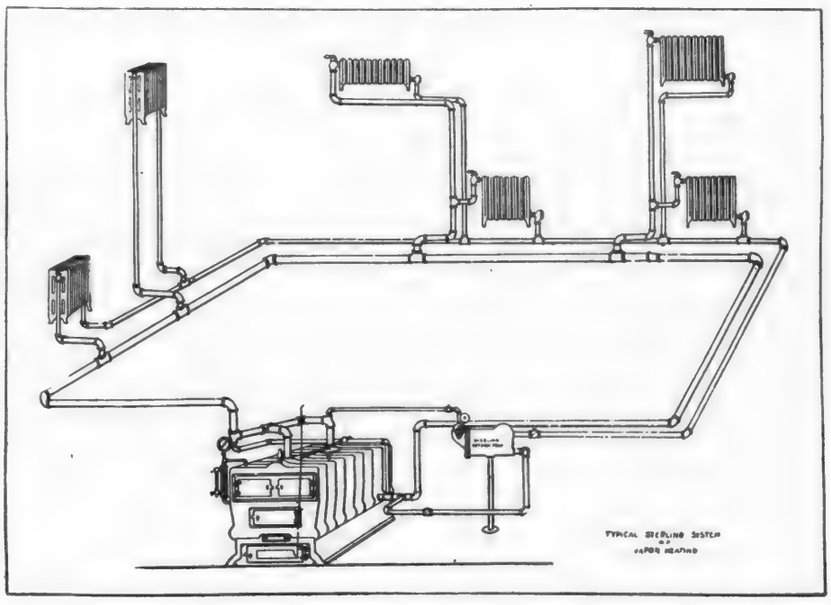
STERLING SYSTEM OF VAPOR HEATING is the title of Bulletin No. 32 just issued by the Sterling Engineering Co., Milwaukee, Wis. The pamphlet gives a theoretical discussion of vapor heating principles in brief, followed by description of various Sterling specialties for use on vapor heating systems, including the Sterling thermostatic trap, graduated packless valve, slide valve return trap, air eliminator, damper regulator, safety valve, vapor gauge, and street ell. There are given also hints on estimating and on installing, operating, and cleaning vapor heating systems, of which a typical installation diagram, as shown herewith, is also contained in this pamphlet. Size 6 x 9 in. Pp. 16, perforated for binding.

MODULATED VAPOR HEATING is the title of a catalog just issued by the Haynes Selling Co., Philadelphia, Pa., in which are described the Haynes adjustable modulating valve, the Hoffman return line valve, and quick vent vapor valve, and the Hoffman equalizing loop. The feature of the adjustable modulating valve is a rotary sleeve which can be set to limit the area of the outlet port in accordance with the amount of radiation to be served, thus adding to the range of regulation possible to obtain with the single valve. The accompanying illustration shows this sleeve set to one half of full port area. A partial list of users and recommenders of Haynes modulated vapor heating is also given in this pamphlet. Size 7½ x 10 in. Pp. 16.

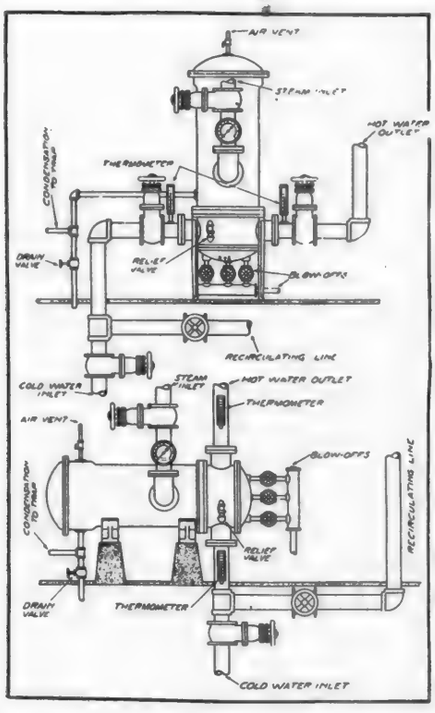


HAYNES ADJUSTABLE MODULATING VALVE.

HEATING AND COOLING EQUIPMENT, comprising the Alberger Buffalo line of heaters for feed-water, heating systems, domestic service, etc.; coolers for gases, oil, air, brine, water and chemicals; also economizers and exchangers, is the subject of new catalogue issued by the Alberger Heater Co., Buffalo, N. Y., and prepared in a way that is bound to make it welcome in an engineering office. Not only are the different types of heaters

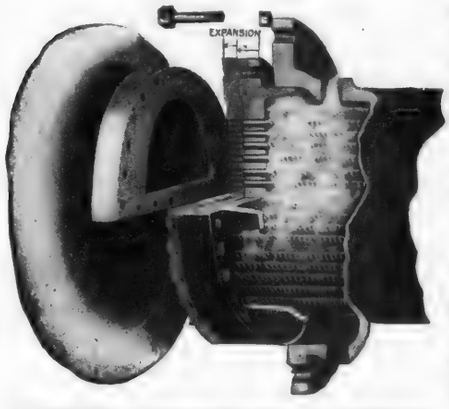


TYPICAL INSTALLATION OF STERLING VAPOR HEATING SYSTEM.



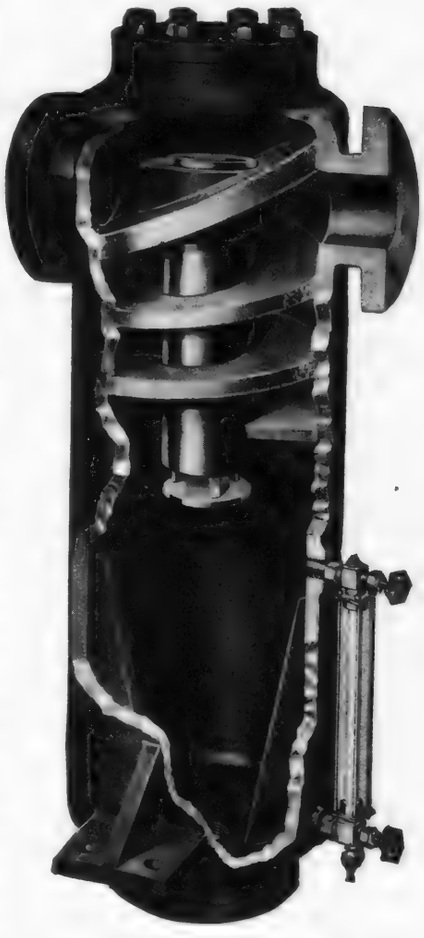
TYPICAL CONNECTIONS TO ALBERGER HEATER, VERTICAL AND HORIZONTAL TYPES.

explained in full, but the illustrations are designed to give a clear and accurate idea of the construction details and principles of operation, while other views show proper connections for both the vertical and horizontal types. In describing the tests that led to the present design, the interesting statement is made that in a comparison between plain copper tubes and corrugated copper tubes, the tests showed that the corrugations increase the heat transmission per square foot over 50% as compared with the plain tubes of the same diameter. The use of cast-iron in the construction is explained in the statement that it is not so subject to rapid corrosion as steel plate. Other points which receive special emphasis are the steam dome cast integral with the shell, providing a large expansion chamber for the steam; and the multi-floating heads, the latter being characterized as an Alberger feature. The necessity for this construction, it is pointed out, is obvious when it is considered that a heater tube, under ordinary working conditions, will expand 3/16-in. The catalogue contains a typical form of specification, the concluding pages being devoted to suggestions for cleaning heaters and engineering data. Size 7½ x 10¾ in. Pp. 48.



ALBERGER MULTI-HEADS, ILLUSTRATING EXPANSION AND CONTRACTION.

NEW STRATTON SEPARATOR is called to the attention of the trade in a leaflet issued recently by the Griscom-Russell Co., New York. This separator is a redesign of the old Stratton separator,



NEW STRATTON CENTRIFUGAL SEPARATOR.

which has already secured recognition as the original centrifugal separator. In the new design the helical path has been lengthened in order to increase the centrifugal separating action and this feature, together with the spatter cap placed on the outlet pipe, greatly increases the separating efficiency. A view of the horizontal type of this separator is given on the leaflet. Size 8½ x 11 in. 1 page.

"THOMAS'" AUTOMATIC ELECTRIC CONDENSATION PUMP AND RECEIVER is described by the manufacturer, Thomas Pump Works, New York, in a leaflet just received, as "The best money can buy or skill produce." The superlative units are built in five sizes to care for systems ranging from 1000 to 100,000 sq. ft. of radiation. The electric automatic control is of this manufacturer's own special design and construction and is positive in operation. The accompanying illustration is taken from this leaflet. Size 8½ x 11 in. Single page.

Date Set for Annual Meeting of District Heating Engineers.

Announcement is made that the forthcoming annual convention of the National District Heating Association will be held at Cedar Point, O., known as the "Boardwalk of the Lakes," during the week of June 15. Headquarters will be at The Breakers. It has been decided to omit the manufacturers' exhibit on the ground that it detracts from the interest in the sessions.

Central Station Heating Notes.

Springfield, Ill.—The Quincy Gas & Heating Company and the Central Illinois Public Service Company, of Charleston, Ill., have been granted permission to raise their gas rates approximately 7%, by the public utilities commission.

Mattoon, Ill.—According to the recent order of the State public utilities commission, the new heating rate effective in Mattoon is shown to be 36 cents gross per square foot of installed radiation, an increase of about 50% over the previous charges. The proposal of the Public Service Company to provide a lower charge per square foot to large consumers was turned down by the commission on the ground that "it does not appear that the heating business in Mattoon is of such a nature as to require a rate of this form."

Springfield, Ill.—Springfield will be the first city in the country to own and operate its own heating and lighting systems, according to City Commissioner W. J. Spaulding, the city voting to take that action at a special election February 22. The city has been operating its own lighting plant for some time. The question decided at the special election was whether the city would absorb its only competitor, the Springfield Gas & Electric Company. The company's franchise would have expired March 10, and announcement was made some time ago by its president that "unless conditions were made better" the company would be compelled to suspend business. The municipal plant was not capable of furnishing the entire city with light and heat so it offered to buy outright the holdings of the Springfield Gas & Electric Company. In arranging for the appraisal it was agreed that the city should appoint one member, the company one and the Chamber of Commerce a third of a board of arbitration to place a valuation on the holdings of the private concern. A clause was in-

serted in the agreement that if the city did not make good in municipal ownership, the properties were to revert to private ownership. The city has extended the electric and heating franchise of the company until September 15, required for consummation of the agreement.

Tacoma, Wash.—Rate increases of 33⅓% are announced by the Consumers' Heating Company of Tacoma. At the same time announcement was made that the company is utilizing the new $250,000 plant which has been constructed on the city waterway at 13th and Dock Streets. The notice states that while the rate has been advanced it still compares favorably with the rates charged by heating plants in other cities of the Northwest. Starting February 1, the following schedule of rates is now in effect:

CONDENSATION PER MONTH.

$1.50 per 1,000 lbs. for first 25,000 lbs. or less consumed.

$1.20 per 1,000 lbs. for next 25,000 lbs. or less consumed.

$1.15 per 1,000 lbs. for next 50,000 lbs. or less consumed.

$1.00 per 1,000 lbs. for next 100,000 lbs. or less consumed.

90c per 1,000 lbs. for next 300,000 lbs. or less consumed.

75c per 1,000 lbs. for next 500,000 lbs. or less consumed.

60c per 1,000 lbs. for all over 1,000,000 lbs.

Minimum charge of $3.00 per month.

Open nets charged for according to size.

QUANTITY DISCOUNT

15,000,000 lbs. annual guarantee consumption, 15% discount.

20,000,000 lbs. annual guarantee consumption, 17% discount.

Much credit is given H. A. Flood, vice-president and general manager, for the excellent mangement of the affairs of the company during the past year. Working in cooperation with the board of directors, which is composed of prominent Tacoma financiers and business men, Mr. Flood has succeeded in giving Tacoma one of the finest central heating plants on the coast. In October of 1919, Mr. Flood, who had had experience in central heating plant management, came to Tacoma and obtained an option on the old Tacoma District Heating Company plant. Owing to the condition of the company at that time, he decided to give up the option and was then persuaded to take over the management of the company under a new board of directors, composed of prominent Tacoma men. At that time capital to the extent of $225,000 was raised and, following the disastrous fire a few months later, additional capital to the amount of $250,000 was secured to build the new plant on Dock Street. The plant burns "hogged fuel," which is sawmill waste that has been ground into small chips. Large fuel storage bins have been constructed at the plant, the sawmill waste arriving in barges. The plant is also arranged to receive either hogged fuel or slab wood by rail or truck. The company has its own hogging machine for emergency. With the new plant the company is able to give a 24-hour service to all of its patrons, and still have a surplus of 33⅓%. This means providing heat for 30,000,000 cu. ft. of space, and also providing steam for the newly-constructed Rust Building, as well as the Elks' Club, the Perkins Building and the uncompleted Scandinavian-American Bank building.

The officers and directors of the company are: W. R. Rust, president; J. S. Baker, vice president; H. A. Flood, vice president and general manager; H. V. Alward, treasurer; H. S. Griggs, secretary; Henry A. Rhodes, William Jones, Everett G. Griggs and W. H. Snell

Waterloo, Wis.—The central heating plant in Waterloo has been found to have more than paid for itself in four years and the consumers have enjoyed heat at a price equivalent to $4.80 a ton for the best Illinois coal. Waterloo is a town of 1600, with three blocks of business buildings, mostly two-story. The central heating plant is 300 ft. from the center of this district. It has a 150 H. P. Corliss type engine, belted to a 100 K. W. 2300 volt generator, and a duplex tandem compound water supply pump of 9-in. stroke. Steam for all three services is supplied by two 125 H. P. tubular underfeed boilers. From the plant to the distributing center are an 8-in. low-pressure steam pipe, a 4-in. return for condensation water, and a 2-in. high-pressure line for booster purposes and to supply consumers desiring 100-lb. steam.

Branching and extending one block in each direction from the distributing center are a 4-in., a 2-in. and a 1-in. pipe—a total of 1100 ft. of heating mains. All these lines are covered with 1½-in. asbestos with canvas jacket, wrapped with bare copper wire, coated with asphalt paint and run through a duct in a concrete-lined trench.

The cost of the plant was $12,200 which later additions for service brought up to $13,197. The net income last season was $14,197.

Evanston, Ill.—The Public Service Company of Northern Illinois has filed a petition in the circuit court to appeal from the decision of the State public utilities commission in regard to an order preventing the company from increasing its heating rates.

Dansville, Ill.—Increased steam heat rates sought by the Danville Street Railway & Light Company were permanently annulled and the application dismissed without prejudice by the State public utilities commission. J. E. Johnson, general manager of the company, said the application, which was made a year or more ago, had already been withdrawn by the company.

Deaths.

W. G. CORNELL, president and one of the founders of the W. G. Cornell Co., New York, heating and plumbing contractors, with branches in many cities, died at his home in Neponsit, L. I., February 2, of pneumonia. He was 57 years old. Mr. Cornell achieved a notable success in his chosen field with which he had been identified throughout his business life. His early experience was gained in Kansas City and Chicago where he was associated with D. M. Quay. In 1895 he became Boston manager of the Wells & Newton Company, of New York, and three years later came to New York, as a third owner of this company. He organized the W. G. Cornell Company in 1898, his associates being Edward Sisson and George W. Simons. This firm soon became a prominent factor in the trade, with offices in twelve cites. Among the contracts executed by the company were the plumbing equipment of the Pennsylvania and Commodore Hotels, the Woolworth Building and the Municipal Office Building in New York, and the Army and Navy Building, in Washington. He leaves a widow, four children and one brother.

FRANK PROX, president and founder of the Frank Prox Co., Terre Haute, manufacturers of the Prox line of heating boilers, died at his home in that city, January 20. He was 80 years old.

EDWARD C. HINMAN, president of the American Steam Pump Co., Battle Creek, Mich., died January 11. He was 69 years old.

CHARLES H. ARMSTRONG, secretary and treasurer of the Armstrong Mfg. Co., Bridgeport, Conn., died in Bridgeport, January 1. He had long been identified with the company and was widely known among the older members of the trade.

SAMUEL A. KINSEY, president of the Kinsey & Mahler Co., Peoria, Ill., died at his home in that city January 9. He was 94 years old.

MARTIN F. SCAIFE, of the William B. Scaife & Sons Co., Pittsburgh, Pa., died suddenly at his winter home in Miami, Fla., January 13. Mr. Scaife who was 65 years old, had retired from the company several years ago, due to ill health.

JOHN L. MOYER, president of the Philadelphia Steam Heating Co., Philadelphia, Pa., died January 20 at his home in Strafford, Pa.

WILLIAM P. THOMPSON, Philadelphia, whose death on January 2 was noted in last month's issue, was the first president of the Philadelphia Local Association of Master Steam and Hot Water Fitters, having been elected in 1894 and serving for several years. He was chairman of the board of directors of the National Association of Master Steam and Hot Water Fitters in 1895 and the following year was elected treasurer of that association.

THE IDEAL TYPE "A" HEAT MACHINE

OWNERS of this highly refined Heat Machine enjoy an average fuel saving of 33⅓%. This is shown by records of thousands of installations. Long recoaling periods and automatic control assure a luxurious heating service hitherto thought not obtainable in the private home.

The compact construction, handsome finish, dust-free jacket and gas-tight doors make it a feature of the remodeled basement.

Send for catalog showing heat test charts and construction detail.

AMERICAN RADIATOR COMPANY

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

FLOW OF STEAM IN PIPES.

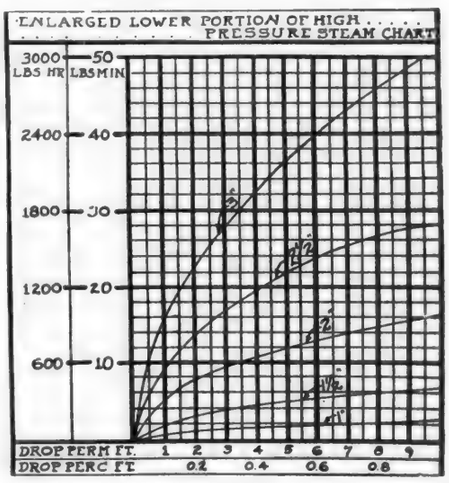
High Pressure Flow in Straight Pipes.

If 125 lbs. gauge or 140 lbs. absolute is taken as an average high pressure and a 100-ft. run as a basis of length, the curves shown in Fig. 1 may be plotted for each size of pipe at various drops and 0 to 10 lbs. per 1000 ft. have been selected as covering all ordinary cases. It can be seen, however, that the drop is inversely proportional to the density—all other factors being the same—and that the delivery is directly proportional to the square root of the densities. From this relationship, the factors, given in Table 1, are derived for changing either the quantity or drop shown by the curves for 140 lbs. absolute pressure to any other absolute pressure.

Example: An 18-in. pipe, which, by the curves, delivers 5100 lbs. of steam per minute at 140 lbs. absolute pressure, with 7-lb. drop, will deliver 90 lbs. absolute, 0.81 of 5100 lbs., or 4131 lbs. with the same drop, or would deliver 5100 lbs. with 1.52 x 7 lbs. = 6783 lbs. per minute with the same loss in pressure (7 lbs.) or will deliver 5100 lbs. with 7 x 0.57 = 3.99 lbs. drop in pressure.

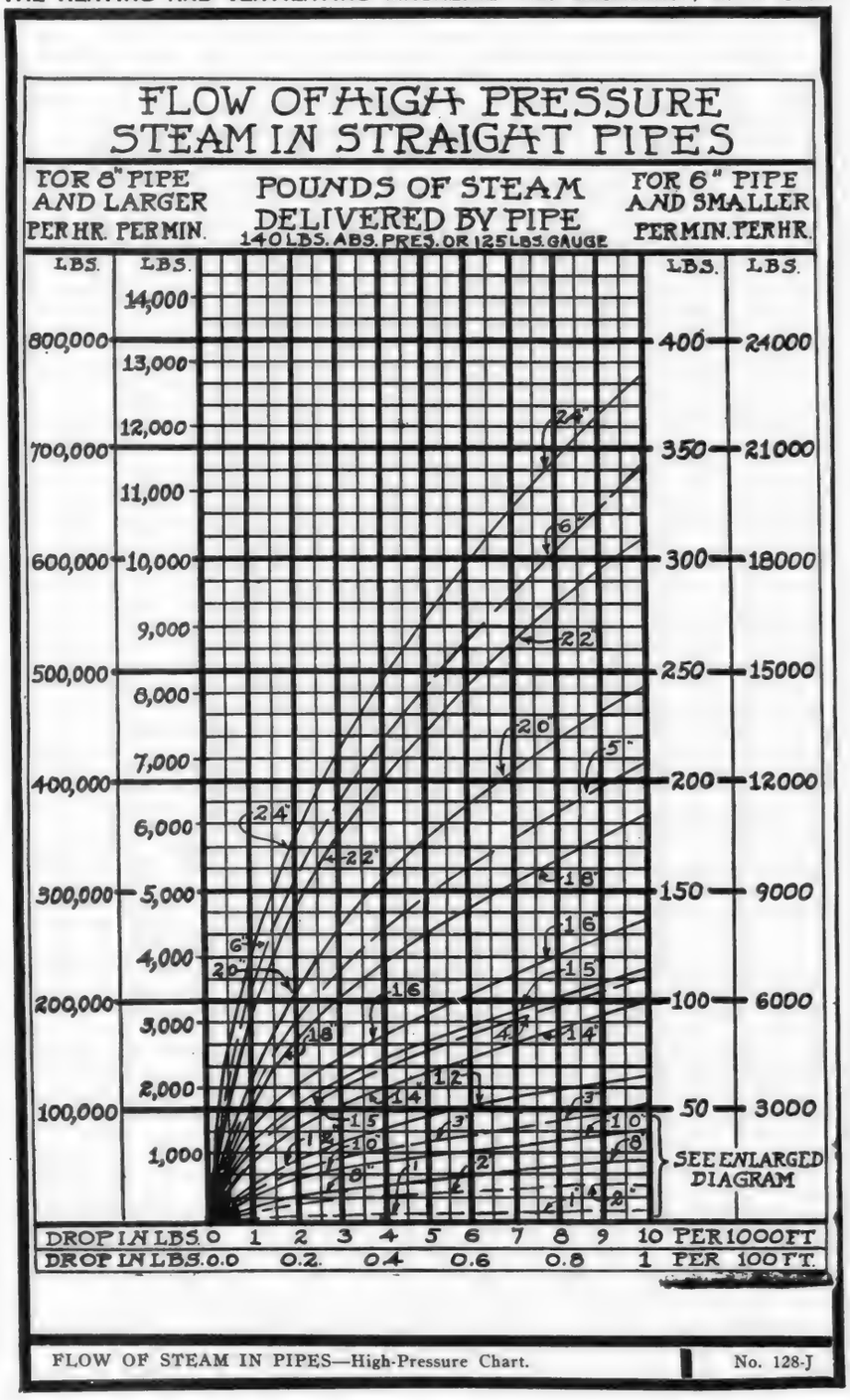
TABLE 1.

Absolute Pressure in Pounds per Square Inch	Multiply Delivery by	or Multiply Drop by
250	1.33	0.57
220	1.24	0.65
200	1.19	0.71
180	1.13	0.79
150	1.03	0.94
140	1.00	1.00
130	0.97	1.07
120	0.93	1.16
100	0.85	1.38
90	0.81	1.52
80	0.77	1.70
70	0.72	1.93
60	0.67	2.22
50	0.62	2.65
40	0.56	3.26
30	0.48	4.27
20	0.40	6.23



FLOW OF STEAM IN PIPES—High-Pressure Flow in Straight Pipes. No. 128-I

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY



FLOW OF STEAM IN PIPES—High-Pressure Chart. No. 128-J

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

FLOW OF STEAM IN PIPES.

Low Pressure Flow in Straight Pipes.

For steam at low pressure, say, 30 lbs. or less, the table prepared by Professor William Kent (Proceedings A. S. H. & V. E. 1907) may be taken as the most generally accepted means of determining the delivery and drop on such lines. From this table (Table 1) the curves shown in Fig. 1 have been plotted.

Table 1—Steam Delivery and Pressure Drop.

Nominal Pipe Size, In. Diam.	Initial Steam Pressure (Lbs. Gage)								
1/2	4.2	4.3	4.4	4.6	4.7	4.8	4.9	5.1	5.3
3/4	9.7	13.0	10.3	10.5	10.3	11.0	11.0	11.8	12.3
1	19.0	19.6	20.2	20.7	21.1	21.7	21.7	23.2	24.2
1 1/4	40.1	41.3	42.5	43.7	44.8	45.9	45.9	49.0	50.9
1 1/2	61.4	63.2	65.1	66.8	68.6	70.3	71.9	75.0	78.0
2	120.8	124.5	128.2	131.6	135.0	138.3	141.5	147.7	153.6
2 1/2	195.7	201.8	207.5	213.2	218.7	224.1	229.2	239.2	248.8
3	345.5	356.1	366.5	376.4	386.1	395.5	404.7	422.4	439.3
3 1/2	505.3	520.8	535.9	550.5	564.7	578.5	591.8	618.0	642.6
4	701.4	723.0	744.0	764.4	784.2	803.4	822.0	857.4	891.6
4 1/2	938.7	967.6	995.8	1023	1049	1075	1100	1148	1193
5	1252	1291	1328	1364	1399	1433	1467	1531	1592
6	2011	1074	2134	2192	2248	2303	2356	2459	2557
7	2936	3027	3115	3199	3281	3362	3440	3590	3733
8	4082	4208	4331	4448	4564	4674	4783	4991	5191
9	5462	5630	5794	5951	6102	6252	6396	6678	6942
10	7314	7536	7758	7968	8172	8370	8562	8940	9296
12	11550	11916	12264	12594	12918	13236	13542	14136	14700

It will be seen that in plotting the curves some pressure had to be assumed as a basis and for this about 20 lbs. absolute, or 5.3 lbs. gauge was adopted, as this is the most commonly used low pressure. For any other pressure or drop, the factors are as given in Table 2.

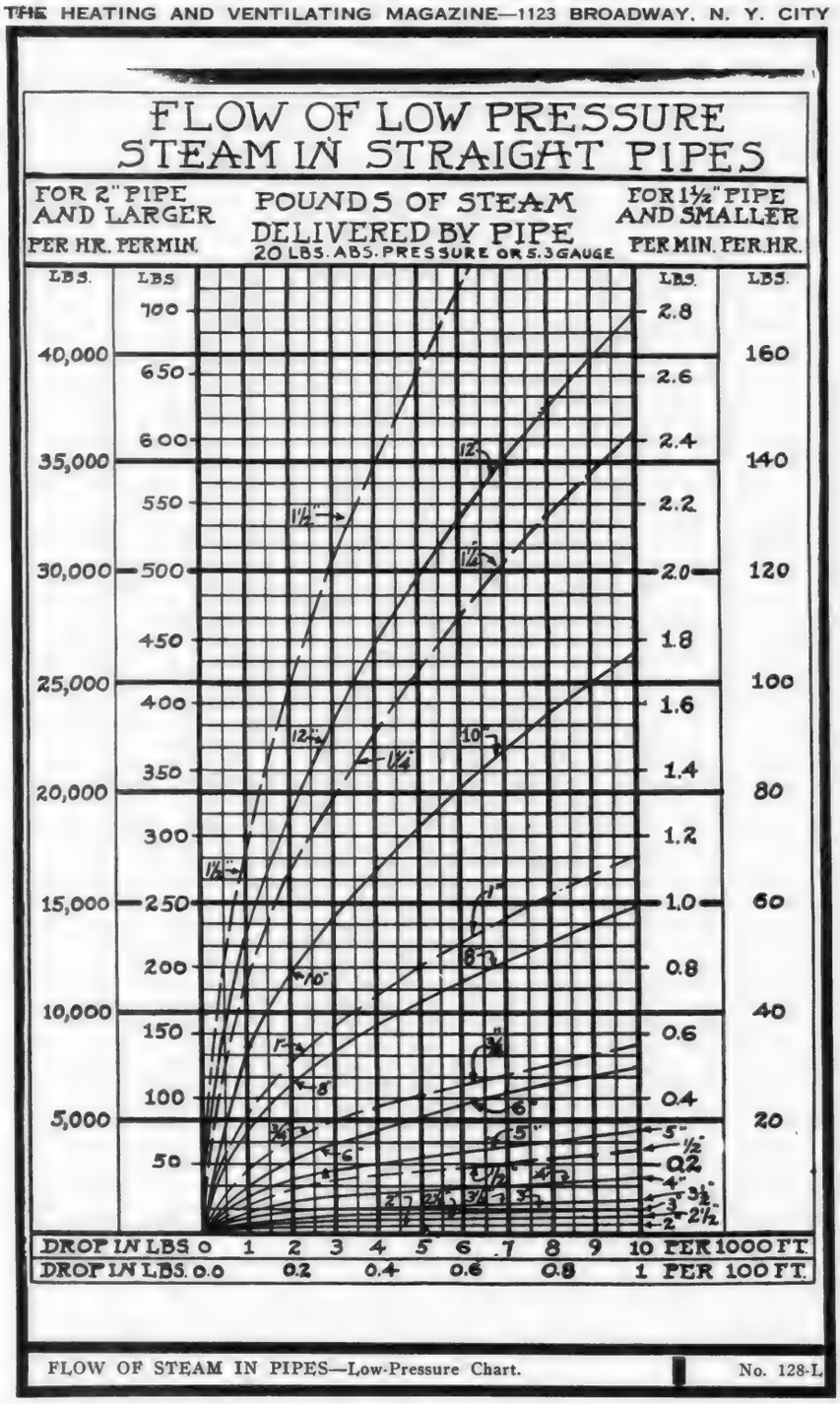
Thus from the curves it can be seen that a 10-in. pipe at 5.3 lbs. gauge (20 lbs. absolute) and 0.6 lbs. drop per 100 ft. will deliver 333 lbs. of steam per minute, while at 1 lb. absolute pressure it will deliver 333 x 0.25 = 83 lbs. with the same drop, or 333 lbs. with 0.6 x 16.56 = 9.9 lbs. drop per 100 ft.

TABLE 2.

Absolute Pressure in Pounds per Square Inch.	Multiply Delivery by	or Multiply Drop by
30	1.21	0.68
20	1.00	1.00
15	0.87	1.31
10	0.72	1.91
5	0.52	3.65
4	0.47	4.52
3	0.41	5.90
2	0.34	8.07
1	0.25	16.56

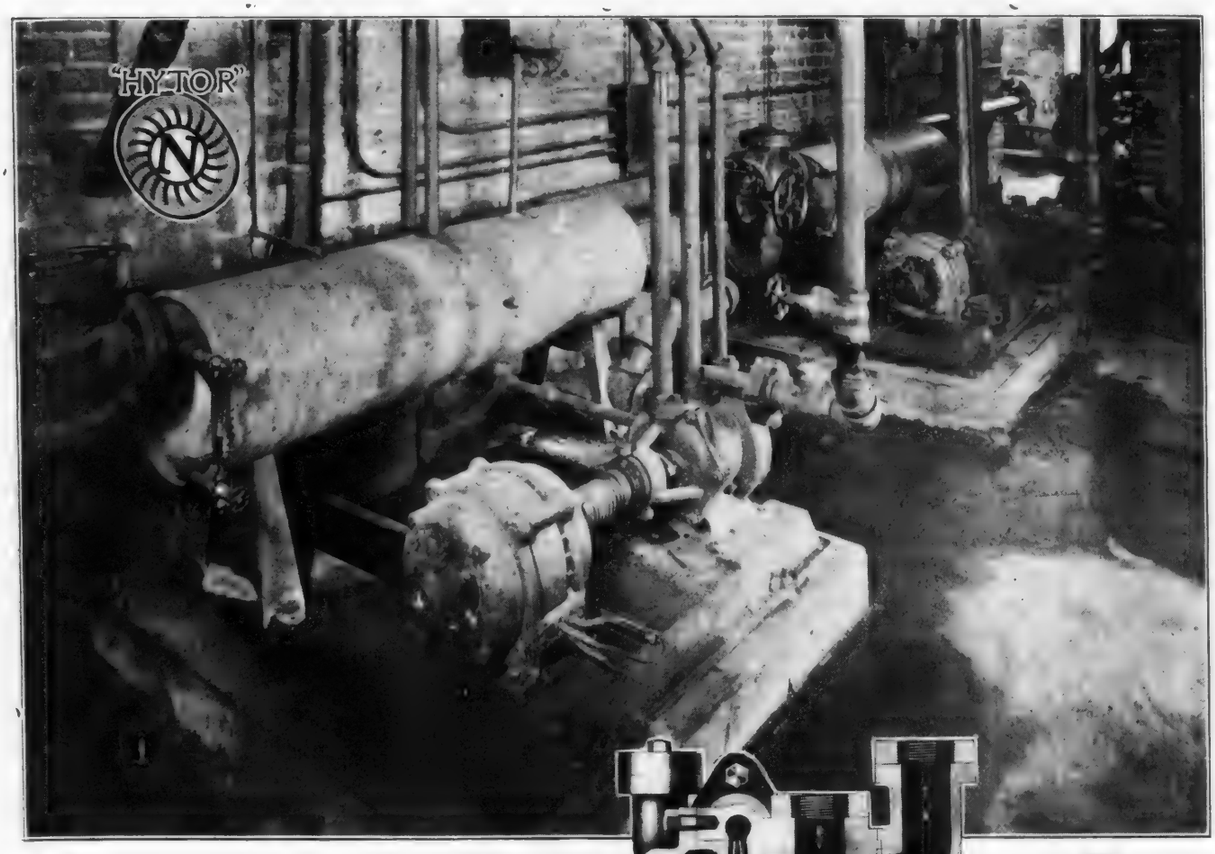
The foregoing does not take into account friction losses. To allow for each loss of pressure an arbitrary percentage may be added to the length of the line—usually 10% for fairly straight runs up to 25% for runs with numerous offsets. There is also a loss of energy encountered where the steam enters the pipe, this consisting of the pressure necessary to produce the velocity attained at the entrance and the pressure loss due to entering the pipe opening. This loss is usually considered as about the same as that obtained with a globe valve. The other large factor which must be considered is that of condensation. This depends on whether the pipe is bare or covered, the fact as to its being wet or dry and to the type and efficiency of the covering used.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY



FLOW OF STEAM IN PIPES—Low-Pressure Chart. No. 128-L

EFFICIENT HEATING *demands the* JENNINGS PUMP

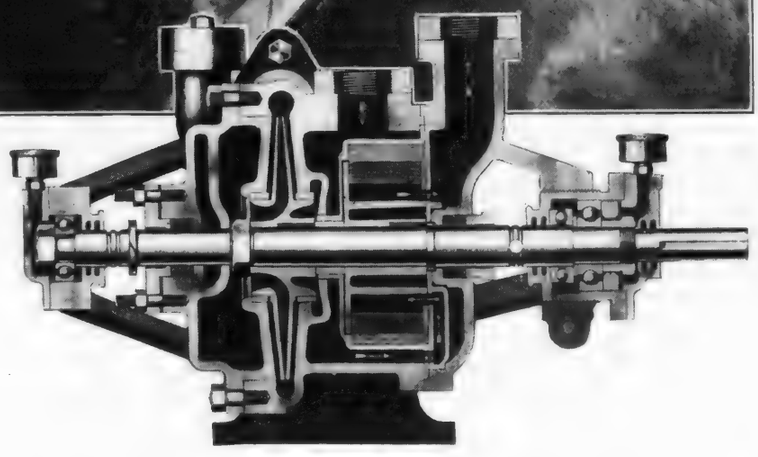


Duplex D Unit, Continuous Operation

HEBB MOTOR COMPANY
Havelock, Nebr.

Capacity each pump 40,000 sq. ft. direct radiation; air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute.

The motors are only three horse power



THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

There are many other reasons why the Jennings is being installed on practically all of the big jobs. Bulletin No. 8 gives them in detail. Write for it.

NASH ENGINEERING COMPANY
SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

Kansas City, Mo.—The heating ordinance, redrafted to meet objections voiced at hearings, has been passed by the lower house of the city council. At the time of writing, the measure was pending in the upper house. In its present shape it provides for the maintenance of a minimum temperature of 68° F. in all buildings where one or more persons dwell and in which heat is furnished. The specified temperature is to be maintained from 6 A. M. to 10 P. M. in dwellings, apartments and hotels, and in office buildings, stores and factories from 8 A. M. to 6 P. M., or during other specified working hours The ordinance does not apply to businesses the nature of which requires a temperature higher or lower than that specified in the ordinance. To meet an objection that unscrupulous tenants might take advantage of landlords by raising windows, a section was added providing that all doors and windows shall be kept closed for an hour before a test is made.

Poughkeepsie, N. Y.—The pertinacity of the warm-air furnace system of heating in keeping its merits before the public is well illustrated in a report received of a fire in a Poughkeepsie store recently. "A firemen left to guard the building," runs the account, "was somewhat surprised to notice, when he stood on a certain spot of the floor, a welcome amount of heat radiating therefrom. Going into the cellar to search for the source of the heat, he discovered that the fire in the furnace had been untouched by the tons of water which had been poured into the basement and the fire was merrily and cosily burning within the confines of the furnace."

Chicago, Ill.—A revised heat ordinance is being drawn up by Alderman Armitage to take the place of the one that was sidetracked recently by the city council. It is proposed to have landlords maintain at least 60° of heat at 6 A. M., 65° at 7 A. M. and 68° at 8 A. M., the latter degree to continue throughout the day and up to 10 P. M.

Cedar Falls, Ia.—Erection of a steam heating plant to cost $200,000 at Teachers' College is contemplated by the State Board of Education, which has asked the Assembly for an appropriation for that amount.

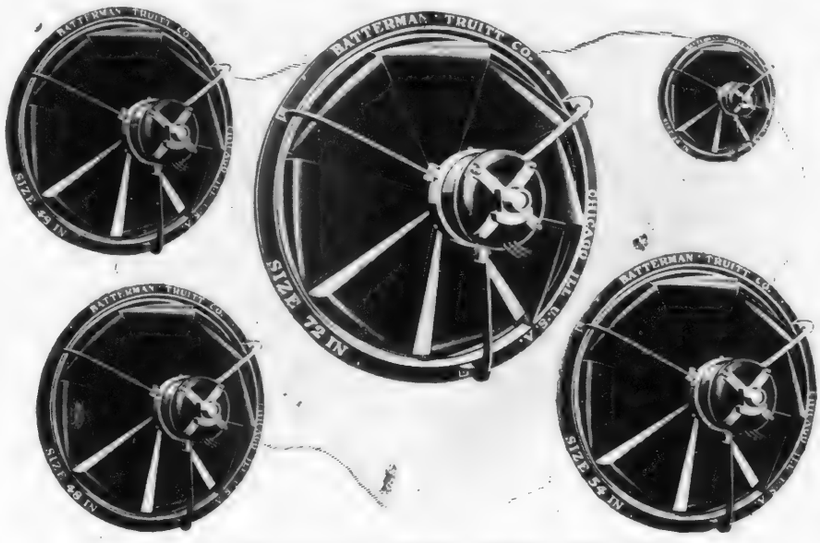
Chicago, Ill.—Plans are going forward rapidly for the "Own Your Home" Exposition which will be held at the Coliseum, March 26 to April 2. The display will include a number of heating and ventilating exhibits.

Baltimore, Md.—In connection with the proposed heat ordinance in Baltimore what has been characterized as a "joker" has been pointed out in connection with the clause which states that the ordinance shall apply only "in the absence of a written contract to the contrary." It is contended that with this loophole, tenants who can not find another place to go would be forced by their landlords to sign leases or agreements waiving right of action under the provisons of the law.

National Pipe and Supplies Association will hold its annual convention in Cleveland, O., May 10-11, 1921, with headquarters at the Hollenden Hotel. Secretary, George D. McIlvaine, Pittsburgh, Pa.

"AUTOVENT" Motor Driven Propeller Fans

Trade Mark



Five Units Furnished for Shaiker Heights High School
Cleveland, Ohio

AUTOVENT FAN MOTORS are rigidly protected against moisture, dirt or sediment entering the windings and working parts, which allows the motor windings to be kept clean and free from injurious substances.

AUTOVENT FAN MOTORS are ventilated the only perfect way, which is by elimination of air passing through the motor windings.

AUTOVENT FANS are especially designed and particularly adaptable for handling steam, moisture, acid fumes, restaurant and hotel kitchen fumes, because the motors are of the protective Autovent type.

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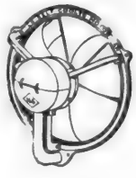
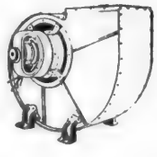
National Trade Extension Bureau held its second annual meeting in Evansville, Ind., January 27-28, when the following officers were elected: President, D. F. Durkin, Jr., President of the National Association of Master Plumbers; vice-president, A. M. Maddock; treasurer, L. C. Huesmann; secretary, William J. Woolley. Finance committee: A. M. Maddock, H. E. Speakman, T. E. O'Brien, L. C. Huesmann, W. C. Chamberlin, C. V. Kellogg, Joseph F. Evans, William Byrd, Jr., R. B. Flershem, B. O. Tilden, H. E. Thorndike, George Mehring, W. A. Brecht and D. F. Durkin, Jr. Secretary Woolley's report showed that 106 trade talks had been delivered, 1071 shops in 144 cities of 14 States had been visited, the T. E. B. lecture course supplied to 387 local associations of contractors, 150,000 monthly service bulletins sent out, 2004 orders for contract and estimating forms filled and 312 T. E. B., bookkeeping systems delivered in 36 States. A budget of $100,000 has been set for the year 1921.

Washington, D. C.—In a survey of the activities of more than 200 chambers of commerce interested in stimulating home building, conducted by a department of the Chamber of Commerce of the United States, it is brought out that belief on the part of prospective buyers that last year's high costs of houses cannot be maintained in a falling market is given as one of the main reasons why housing companies have encountered difficulty in trying to dispose of new houses during the past six months. The "slack" in employment is another reason attributed by housing companies sponsored by local chambers of commerce for the slump in the market. The survey shows that 57 housing and financing companies have started or completed the building of 5714 houses, and have made plans for building 1000 more. In 50 other cities no housing companies have been created. The paid-up cap-

At a very small initial cost and a few cents a day for operation, you can enjoy ideal air conditions by installing one or more ILG Self-cooled Motor Propeller Fans. Let us fully explain how ILG Ventilating Equipment can permanently banish the dangers of stagnant atmosphere, excessive heat, smoke, moisture, fumes, gases, etc.



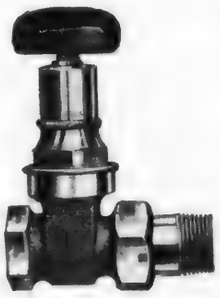
The ILG Self-Cooled Motor Propeller Fan is the only one made with a fully enclosed self-cooled motor—scientifically cooled by a patented vent pipe which connects with the heart of motor. The guarantee covers the complete unit.



ILG Universal Blowers are built with universal discharge. Motor and blower built together—requires no foundation or pedestal—easy to install—economical to operate—one of the most efficient blowers made. We build and guarantee complete unit.

ILG ELECTRIC VENTILATING CO.
158 Whiting Street **Chicago, Ill.**
Branches in all large cities

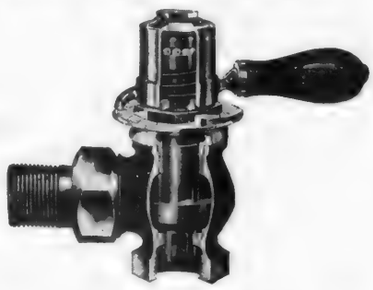
Dole



WE elected years ago to be the builders of the best radiator valves on the market. We have succeeded in our ambition. If any man desires to study the radiator valve field—he will become convinced of the fact that Dole Radiator Valves dominate their market.

A VALVE FOR EVERY SYSTEM

Write for catalogue and discounts



DOLE VALVE CO., Chicago, Ill.
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Jenkins Brass Hose Valves

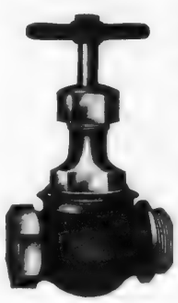

Figure 113

For 250 pounds working water pressure. Do not stick at the seat and respond instantly to a turn of the wheel, and permit a free, unobstructed flow. Fitted with Jenkins renewable disc. Threaded with hose connections. Globe and Angle types. Fig. 112 Angle. Fig. 114 Angle, screwed inlet with cap and chain. Fig. 114-a Globe, screwed inlet with cap and chain.

Genuine Jenkins Valves are obtainable through supply houses everywhere, and are known by the name and Jenkins Diamond Mark cast on the body.

JENKINS BROS.

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Jenkins Valves SINCE 1864

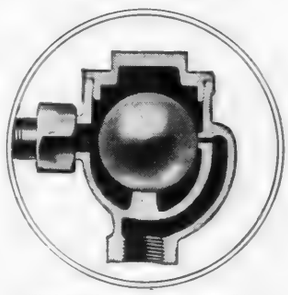
It works without works

HERE'S the simplest radiator trap made—the Johns-Manville Radiator Trap. It operates continuously and faithfully—without any fussy mechanism to get out of adjustment or order.

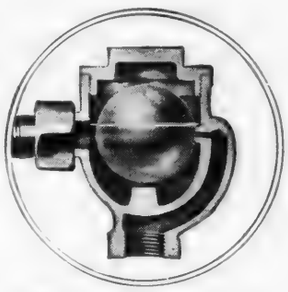
Thousands of Johns-Manville Radiator Traps in satisfactory service bear witness to their good repute.

The unattached floating ball is the only moving part of a Johns-Manville Radiator Trap. Part of its surface acts as the valve; its radius as the lever arm and its weight as the counterweight. The forces that control its movement are the buoyant force of the liquid and the unbalanced pressure on the area of the discharge orifice.

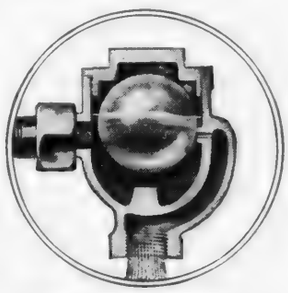
Look at the illustrations which show clearly why the Johns-Manville Radiator Trap is the most efficient and dependable trap you can buy—yet the price is within reason.



The empty trap, ball resting on the post.



Water, steam and air enter trap and ball floats, covering discharge orifice.



Water level rises still further, ball rises, uncovering discharge orifice. Water and air flow from trap.

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Toronto

JOHNS-MANVILLE Radiator Trap

ital of 48 companies returning figures on the subject amounts to $11,863,141. A majority of the companies reporting specified that they favored the plan of selling houses, rather than renting them. Thirty-one companies reported having had difficulty in obtaining building materials. Many reported price reductions during the last few weeks, 33 expected reductions in the Spring, five were doubtful and eight did not anticipate reductions.

Building Operations in January, 1921, are distinctly encouraging, according to statistics compiled by the F. W. Dodge Company. Contracts awarded in the 25 northeastern States amounted to $111,807,000, an increase of more than 11% over the December figures, and more than double those of January, 1919. The January total included 28% for residential buildings, 22% for public works and utilities, 18% for business buildings and 14% for industrial buildings. In New England residential work predominated among the contemplated projects. In New York State and northern New Jersey the figures were $21,635,000, an increase of $2,000,000 over the December figures, the largest item being for industrial buildings. In the Middle Atlantic States the increase was 17% over December, mostly for residential work. In the Pittsburgh district, the increase was 40% over December, the largest items being residential buildings and public utilities. January building contracts in the Central West showed a gain of 7% over December, the item for public works and utilities predominating. A slight drop from the December figures was reported from the Northwest, the largest items in that section also being for public works and utilities.

American Society of Refrigerating Engineers has unanimously adopted the recommendations of a joint committee definitely fixing the "Standard Unit of Refrigeration" as the equivalent of the absorption of 288,000 B. T. U. of heat. This is the heat required to melt one ton of ice.

Mining New Capital for the Development of American Business is the way the U. S. Treasury Department describes its proposed Industrial Savings Plan to encourage earners to save and invest a large percentage of their income. Employers are asked to help in forming savings associations among their men and adopting one of four plans proposed by the Treasury Department. One of these is the "New Dollar Savings Plan," in which, at the employer's request, $1.00 Treasury savings stamps are substituted in pay envelopes for an equal amount of money. According to another plan (Treasury Investment Plan) the employer withholds a given amount from the pay envelope and invests it at once in $5.00 War Savings stamps. The third scheme, which is somewhat similar, is designated the "Liberty Loan Plan," while the fourth plan (The Savings Committee Plan) makes it easy for employees to purchase 25-cent Thrift stamps, $1.00 Treasury Savings stamps and $5.00 War Savings stamps through a Savings Committee. Details of the various plans are obtainable from any of the Government Loan Organizations, that for the Metropolitan district being at 140 Broadway, New York.

Washington, D. C.—In adopting a program looking to the improvement of the housing situation, the Chamber of Commerce of the United States recommends, among other things, the setting of "minimum standards of light, ventilation, water supply, sanitation and proper construction and maintenance for all dwellings."

San Francisco, Cal.—Industrial peace and industrial progress in San Francisco have been reasonably assured by a permanent arbitration agreement which has recently been signed by the San Francisco Building Trades Council, representing the workmen, and the San Francisco Builders' Exchange, representing the employers in the building trades. Under this agreement, the building contractors and the workmen have voluntarily set up a permanent Board of Arbitration and have bound themselves to submit to this Board of Arbitration for final decision all questions involving wages, hours and working conditions.

New School for Social Research, 465

HACKNEY "V" Blade Blower
Full Housed Overhung Pulley Type

Architects and Engineers:

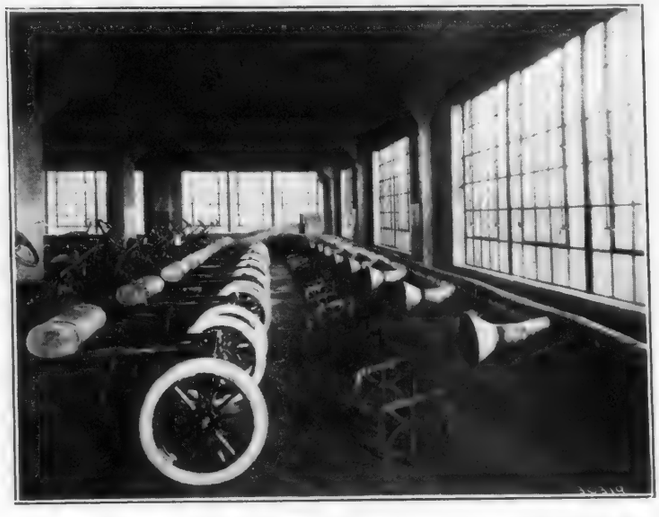
Send for dimension and data book on Hackney "V" blade blowers.

Sales agents wanted in all territories.

Specify HACKNEY "V" Blade Blowers

Why? Because the "V" blade feature—

1. Increases Velocity.
2. Increases Capacity.
3. Increases Strength and Rigidity.
4. Increases Momentum.
5. Increases Satisfaction.
6. Reduces Horse Power.
7. Reduces Vibration.



Exhaust system with Hackney "V" Blade Blower installed in a Ford Motor Co. assembling plant. Carries away gases from 25 cars being tested at one time.

HACKNEY MANUFACTURING CO., St. Paul, Minn. Manufacturers of Blowers and Ventilating Equipment for over 12 years

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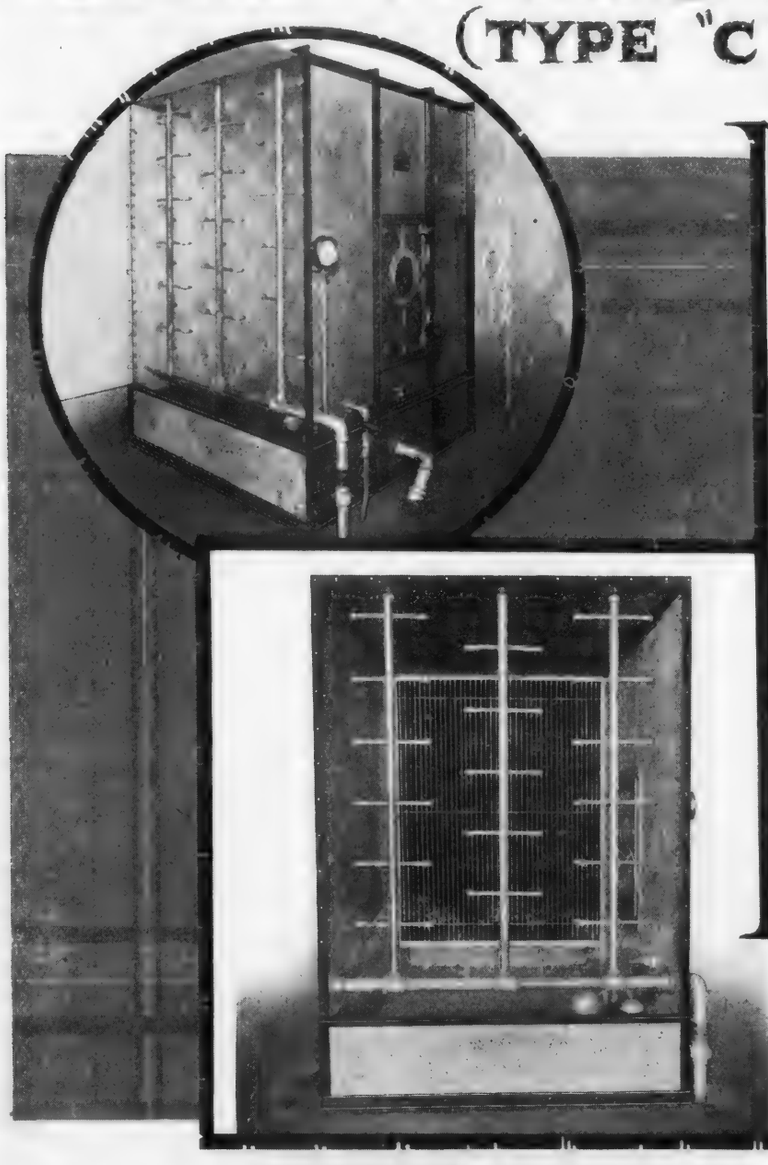
SPRACO
AIR WASHERS
(TYPE "C")



SPRACO
AIR WASHER
EFFICIENCY

Attested by the leading Engineers the world over

The Engineer stakes his reputation on the satisfactory operation of the equipment which he has recommended.

His recommendations must, therefore, be the result of calm, deliberate judgment.

We will be glad to tell you WHY the

Spraco Type C Air Washer

is the preference of discriminating engineers.

Spray Engineering Company
Boston. Mass,

THE·CENTER·JET·NOZZLE
Highest Efficiency by Test

West 23rd Street, New York, announces a conference, once every month, between engineers and economists on the subject of "The Function of the Engineer in the Social Structure." These conferences will be held at the auditorium of the school, began February 9. No charges, it is stated, of any sort will be made.

Washington, D. C.—Senator William M. Calder, chairman of the Special Committee on Reconstruction and Production, has introduced in the Senate the first bill based on the investigation and recommendations of this committee. It proposes a means of relief in building finance by authorizing mortgage loans from funds in saving departments of national banks up to 50% of their assets, subject to regulation by the Federal Reserve Board.

New York.—The conviction of Robert P. Brindell, characterized as the "czar of he building trades," on the charge of extorting $5,000 from a building contractor, Max Aronson, on threat to call a strike unless the money was forthcoming, has served to ease the tension in the building trades in the metropolitan district. This tension was caused by the fear that the efforts of the Lockwood Investigating Committee might prove abortive. Color to this view was given in the action of the State legislature in limiting the new powers granted to the committee so as to exclude the investigation of financial institutions and their relation to the housing situation. It is felt in many quarters that if steps can be taken to provide plenty of mortgage money, the year 1921 will be one of great prosperity for the heating and plumbing industries. As matters now stand with the Lockwood Committee, the legislature has empowered it to continue its investigation along the same lines as have already been followed.

Eastern Supply Association at its regular winter meeting at the Hotel Astor, New York, February 9, was addressed by Dr. Thomas Darlington, former Health Commissioner of New York City, who spoke on the subject of industrial hygiene; Thomas K. Holden, statistician of the F. W. Dodge Co., New York; who spoke on the building outlook for 1921 predicting an increase of about one-third in volume of construction over 1920; and E. St. Elmo Lewis, former advertising manager of the National Cash Register Company.

Central Supply Association held its 84th regular quarterly meeting in Chicago, February 16, when reports were presented indicating that within the next 60 or 90 days would witness a marked revival in business. The discussion brought out the fact that stocks in producers' plants are large, plant economies are being made in many directions and prices are being based on a narrow margin of profit. Jobbers' stocks were reported low. Several members likened the conditions prevailing to the corresponding period in 1919, when the first half of the year was extremely quiet, but the latter half showed marked improvement. It was the opinion of the meeting that much benefit could be derived if the summer meeting were made a joint meeting with the East Supply Association.

J. P. Dugger, secretary of the Kewanee Boiler Co., Kewanee, Ill., who has been seriously ill for some time, will have the sympathy of his many friends in connection with the operation which necessitated the amputation of his left leg, above the knee. The operation was performed at St. Luke's Hospital, Chicago, February 16.

Heating and Piping Contractors' Wisconsin Association elected the following officers at its annual meeting, held in Milwaukee, January 17: President, James B. Sullivan, Stevens Point; vice-president, John S. Jung, Milwaukee; secretary and treasurer, Joseph H. Volk, Milwaukee; sergeant-at-arms, Otto Biefeld, Watertown.

Manufacturers' Notes.

Batterman-Truitt Co., Chicago, Ill., manufacturer of motor-driven fans and blowers, has negotiated a lease covering additional floors in the Gordon Building, at 736-740 West Monroe Street, Chicago, thus tripling its facilities and equipment. The rapid growth of the company during the past six

Meet that Peak Demand for Hot Water

WITH A

Sims Clean E-Z Steam Tube Heater

For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings, Schools, etc.

For Live or Exhaust Steam

Especially Designed for Supplying Large Quantities of Hot Water

Send for tables showing heat capacities using steam at various pressures

"We keep others in hot water"

THE SIMS CO., 18th St., Erie Pa.

This department store veteran installation furnishes the R. H. Macy & Co. store with an unfailing supply of purified air.

EIGHTEEN YEARS OF SERVICE

"Sirocco" TRADE MARK

IN 1902, R. H. Macy & Co., of New York felt the need of adequate ventilating equipment, and installed a complete "Sirocco" Ventilating System.

Today, after 18 years of steady use, this "ABC" Installation is giving the same kind of satisfactory service as it did at first. This continuous performance is duplicated in many other places where "Sirocco" Products are in use.

It is no light task that the ventilating equipment is called upon to perform in such a mammoth department store. It must not fail to accomplish its work because the functions of the entire business depend to a surprising extent upon the circulation of fresh, clean air throughout the store.

R. H. Macy & Co. Department Store, New York City

AMERICAN BLOWER COMPANY
DETROIT, MICHIGAN

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

years has furnished convincing evidence of its conservative business policies and has led to the company's outgrowing its present manufacturing quarters. The officers of the company, who have been identified during this period with the firm's expansion, are: President, Joseph E. Truitt; vice-president, Emil Ackerman; secretary-treasurer, Theodore F. LeJeune.

Utica Heater Co., Utica, N. Y., has increased its capital stock from $250,000 to $550,000.

McNab & Harlin Mfg. Co., New York, announces an increase in its capital stock from $300,000 to $900,000.

American Radiator Co., Chicago, Ill., which announced a 20% cut in prices of cottage-sized boilers and radiators at the beginning of the year, and a reduction of 12½% in the price of large apparatus, has had its action characterized as the most significant slash yet recorded in building materials; the company is frank to say that it means the sacrifice of profits for the next six months. After that it is figured the additional volume will make up the difference. The statement is accompanied by some interesting statistics in which it is pointed out that only 20,000 homes were built in 1918 and only 70,000 in 1919. The figures for 1920 are not available. In 1918 there were 600,000 marriages and in 1919 1,000,000. Normally there are 900,000. "What's the answer," continues the statement, and answers it by saying, "Everyone's gone home to live with dad. Our idea is to help the ordinary man to get his own home. We do about 65% of the boiler and radiator business. We don't owe the banks a dollar and we're willing to take a shot at running half a year without profits."

Standard Heater Co., Williamsport, Pa., has succeeded to the business of the Williamsport Radiator Company, and will continue to manufacture and sell Craig boilers and Norka radiators. Due to the fact that at the beginning of the year the Spencer Heater Company, of Scranton, transferred to the Williamsport Radiator Company all right, title and interest in the manufacture and sale of the Spencer magazine-feed heater, the Standard Heater Company will also manufacture and sell the Spencer line.

Titusville Iron Works Co., Titusville, Pa., announces that the prices of all Titusville boilers were reduced on February 1 from 10% to 15%. The company states that its costs remain about the same, but that it is making this reduction in order to help stimulate new building.

United States Radiator Corporation, Detroit, Mich., announces that R. Ward Hillman, manager of the corporation's Kansas City branch, has been promoted to the general sales department in Detroit. The new manager of the Kansas City branch is W. A. Russell, formerly with the Denver branch.

Republic Boiler & Radiator Co., Baltimore, Md., recently organized with a capital stock of $1,000,000, will build a new plant on Union Avenue, Woodberry. Among the principals in the company are Enos S. Stockbridge and William Lentz.

Contracts Awarded.

Salt Lake City, Utah.—With the signing of a contract with the Jesse Coogan Engineering Company for the remodeling of its present steam heating equipment into a complete water heating systems in all of the buildings comprising the Dr. W. H. Groves' L. D. S. Hospital, is seen the beginning of an improvement and enlargement of the hospital into one of the largest and most modern institutions of its kind west of Chicago. The work involves changing over 20,000 sq. ft. of vacuum steam radiation to a Coogan system of water heating, the estimated cost being $25,000. The Latter-Day-Saints Hospital is owned and operated by the Mormon Church and, when the new wing is added, the hospital will have 300 rooms.

Duluth, Minn.—Bids were received as follows for the heating and ventilating of the new high school building in Coleraine, Minn.: Frank Spencer, Minneapolis, $90,180; M. Kelly Co., $71,180; Healy Plumbing & Heating Co., $84,575; A. C. Schirmer, $92,252; Stack Bros., $81,600; American Plumbing & Heating Co., $78,885; D. R. Black, Du-

Announcement!

We are now in position to furnish the following products in addition to our regular line of Buckeye Fans. We will appreciate the opportunity of quoting you on any of these products.

Buckeye Mixing Dampers **Buckeye Volume Dampers**
Buckeye Cast Iron Registers **Buckeye Faces and Borders**
Buckeye Aluminum Back Draft Checks for Vent Registers
Buckeye Heat and Vent Registers and Faces
Buckeye Woven Wire Grilles—Faces—Guards and Railings

Write Dept. D

Mushroom Floor Outlets

BUCKEYE

Quadrant Damper Operators

BLOWER COMPANY
TOWN AND LUCAS STS.
COLUMBUS, O.

FANS FOR ALL PURPOSES

Increased Production

Up-to-the-minute concerns know that comfort of their employees is the first essential to good production.

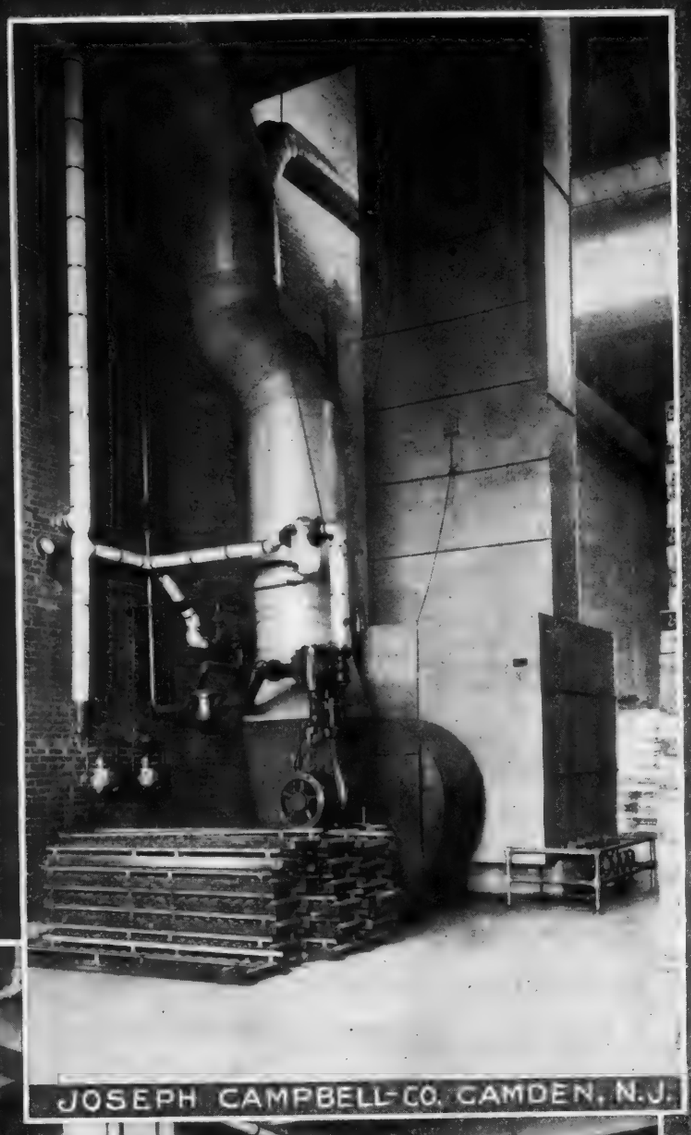
Buffalo Heating & Ventilating apparatus is installed in hundreds of manufacturing concerns.

Catalog 700-36 gives complete engineering data.

Write for your copy.

Buffalo Forge Co.
BUFFALO, N. Y.

"Buffalo"



JOSEPH CAMPBELL CO. CAMDEN, N.J.

BEECH NUT PACKING CO. CANAJOHARIE, N.Y.

luth, $83,840. The plumbing bids ran from $39,900, submitted by D. R. Black Duluth, to $48,967, submitted by Cy Gibson, Minneapolis.

Decatur, Ill.—Suggestions to its patrons to install their own individual heating plants are made by M. L. Harry, general manager of the Decatur Railway & Light Company, in a recent statement in which he declared that "if we cannot get money to rebuild our heating mains during the coming summer, we will have a hard time geting through next winter." The company has made application to the public service commission for an increase in its heating rates.

"Screenings" for the Benefit of the Trade.

"In the Public Eye" is not an epic of the aduventures of a mote of dust near the Flatiron Building on a windy day, but merely the caption of a pamphlet recently issued by the Standard Slide Corporation of New York, advocating the cinema method of advertising the businesses of heating contractors. According to this pamphlet, the advantages of motion-picture advertising are the ability to concentrate the campaign to the immediate neighborhood of the establishment and the ability to present the advertising in an attractive way for quick results. While the appeal of this pamphlet is aimed particularly at the heating contractor, the suggestion is also made that this same publicity means can be used to advantage by the manufacturer in addition to press publicity by insertion on the film or slide of the names of local dealers.

Engineering Foundation Still Encouraging Research.

Two additions to the tales of adventure being published by the Engineering Foundation, New York, have recently come to light. Narrative No. 2 is captioned "Fatigue of Metals: A Story of Co-operation" and deals with the alliance formed between the National Research Council, the Engineering Foundation, and the Engineering Experiment Station of the University of Illinois for an attack upon the problem of metallic fatigue. From the start the contest was very evidently unequal but when these institutions were later joined by the General Electric Company the metals were put to route.

"Utilizing Low-Grade Ores: An Iron Story" is the way in which the third narrative heralds its attack upon aluminum as the king of metals. It deals with the very practical problem of developing methods of smelting which will handle euconomically the lower grades of iron ore which have so far been passed over in favor of the richer grades and those in which the metal could be more easily and cheaply extracted.

Mt. Carmel, Ill.—Permission to abandon its central station water heating plant in Mt. Carmel has been asked of the State public utilities commission by the Mt. Carmel Public Utilities and Service Company. The heating service is unprofitable, according to the company.

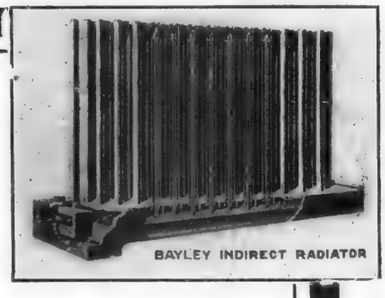
WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceeding date of issue.

Sales Engineer and Contractor, with large following among architects, engineers and builders, desires connection with established heating and ventilating contractor, preferably New York City. Has designed and installed some of the largest heating and ventilating plants in this country and could furnish unquestionable references as to ability and character. Limited partnership preferred in a live concern desiring to increase its business, but will consider salary and commission basis. At present engaged, but at liberty after April 1, 1921. All communications considered confidential. Address Tex, care of Heating and Ventilating Magazine.

Simplify Your Heating, Ventilating and Drying Problems

by letting our engineers furnish you with plans, specifications and give you the benefit of their many years of practical experience on problems similar to yours.



Bayley Chinook Heaters and Plexiform Fans

are the result of the practical application of a thorough knowledge of heating and ventilating requirements. The Chinook is the only heater that can be repaired without taking down the entire section, and the only one that can be shipped "knock-down." Plexiform Fans are designed for durability, efficiency, ease of operation and are accurately balanced.

Full information of these and other Bayley specialties free on request.

BAYLEY MANUFACTURING CO.

Dept. E **Milwaukee, Wis.**

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

DEL. & HUDSON OFFICE BLDG. & STA. WITH ALBANY JOURNAL BLDG.

Equipped throughout with batteries of Massachusetts Fans

Massachusetts Fans

MASSACHUSETTS "Squirrel Cage" Fans combine exceptionally high operating efficiency with a ruggedness and durability of construction that reduces both the operating and upkeep expense to a minimum. Each installation is "tailor made" for the individual building, and is personally inspected and supervised for a greater or less period of time after installation, to assure maximum efficiency.

Where may we send you ALL the facts about MASSACHUSETTS FANS?
Or—"Look us up in Sweet's," page 1483

"Squirrel Cage"

MASSACHUSETTS BLOWER CO.

Watertown, Mass.

Branches in 20 principal cities throughout the country

LEHIGH UNIT HEATER

"PUTS HEAT WHERE YOU WANT IT"

CONSTRUCTION

The Lehigh Unit Heater is a strong, sheet-steel housing, enclosing a fan and Vento Heater.

OPERATION

By means of the fan, usually motor driven, the cold air is taken from the floor, drawn over the Vento Heater and discharged under low pressure through the outlet of the heater.

ADVANTAGES

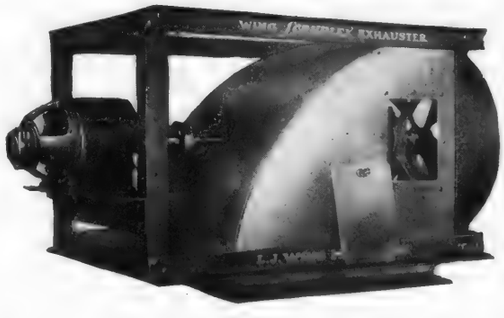
1. Puts heat where you want it.
2. Distributes heat near the floor—not at the ceiling.
3. Provides the most flexible system of heating known. Being portable, is easily moved to any desired part of the building.
4. Eliminates duct work.
5. Cuts power consumption.
6. Spells the greatest economy and efficiency.

Write for special Unit Heater Folder

HERSH BROTHERS COMPANY, 655 Mill St., Allentown, Pa.

I have been Looking for Years for Equipment like That!

The above is quoted from a conversation we had with a well known Consulting Engineer. He further stated that he had very often specified fans of the centrifugal type just to keep the motor out of the duct, when he knew quite well that a good powerful fan of the propeller type would have fitted the job much better.



The characteristic construction of

THE WING-SCRUPLEX EXHAUSTER
REG. U.S. PAT. OFF.

Here is shown part of the Fourteen paint spray booths connected to two WING-SCRUPLEX EXHAUSTERS on the roof, illustrated in our February advertisement.

combines the latest development in fan design—The Wing-Scruplex Fan—with a housing of convenient design in which the motor is easily accessible on the outside, clear of the path of the air being handled.

It economizes in:

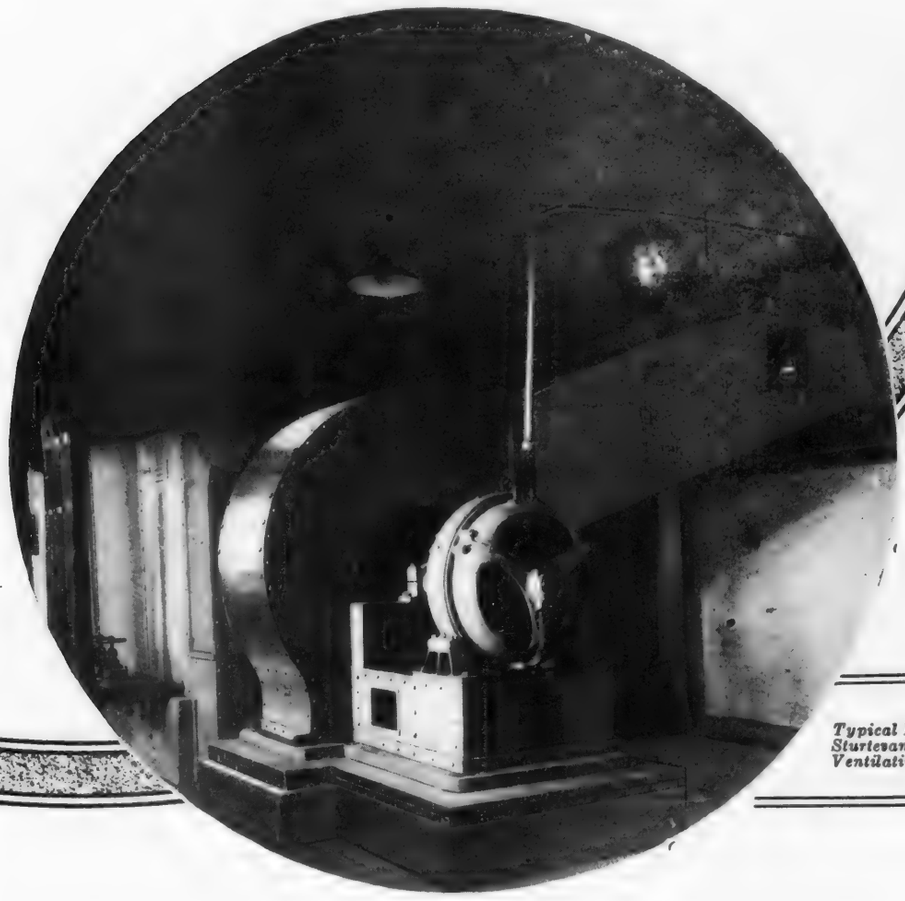
Space, because it is installed as an elbow in tne run of duct;
Cost of installation, because its cost is low and requires no heavy, expensive foundations;
Cost of operation and upkeep—perhaps more important than any other item of economy, because it is continuous.

Can be supplied with air inlet at the top, bottom, either side, or with two inlets, one at one side and one at the opposite side, or one at top and one at bottom.

For full details send for Bulletin 58-B

Fans and Blowers all Types **L. J. Wing Mfg. Co.** Damper Regulators Small Turbines

Hudson and 13th Sts. **New York City**



Typical Installation of a Sturtevant Heating and Ventilating System.

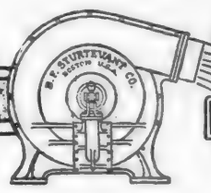
There can be no Question as to the Efficiency of a Sturtevant System

Sturtevant engineers have spent years in the developing of Sturtevant Heating and Ventilating Systems. They have made exhaustive study of every condition under which Sturtevant Systems are to operate.

The great number of Sturtevant installations in every type of public building and industrial plant, the success of each installation and the satisfaction due to the efficiency of the apparatus in providing an abundance of fresh heated air, is proof enough that Sturtevant Systems are absolutely beyond question in reliability.

B. F. STURTEVANT CO., Hyde Park, Boston

AND ALL PRINCIPAL CITIES



Sturtevant

REG. U.S. PAT. OFF.

PUTS AIR TO WORK

SERI-VANE FANS

are conservatively rated, giving that dependable assurance which means so much to careful Engineers, Contractors and Owners. You will find the same care is exercised in the manufacture of the product itself as is used in the compilation of the capacity tables.
When you want Fan satisfaction, specify

SERI-VANE FANS

THE NEW YORK BLOWER COMPANY
513 Transportation Building
CHICAGO
Factory: LaPorte, Indiana
Branch Offices in all large cities

Right Hand—Single Width
CYCLOIDAL MULTIVANE FAN
Patented May 26, 1908

"The Fan Runs Beautifully, in Fact, in all Our Experience no Fans have Performed Better"

This is what a Prominent Eastern Engineer writes us about a recent Cycloidal Fan Installation

Cycloidal Multivane Fans are a genuine combination of efficiency and quality.

The vanes or paddles of the wheel are set at an angle parallel to the shaft, permitting an unrestricted flow of air from the inlet across the entire width of the wheel.

Proper mechanical design and use of highest grade materials and workmanship obtainable, assure durability.

Sectional catalog No. 200 contains full description, with capacity tables, dimensions, etc.

Our engineering department will serve you gratis, on any fan or blower problem.

GARDEN CITY FAN CO., Mfrs.
Estb. 1879
McCormick Bldg. CHICAGO, ILL.

Westinghouse Ventilating Equipment in the INDUSTRIAL PLANT

W
WESTINGHOUSE ELECTRIC

Westinghouse engineers have specialized in the design of high grade equipment for ventilating work.

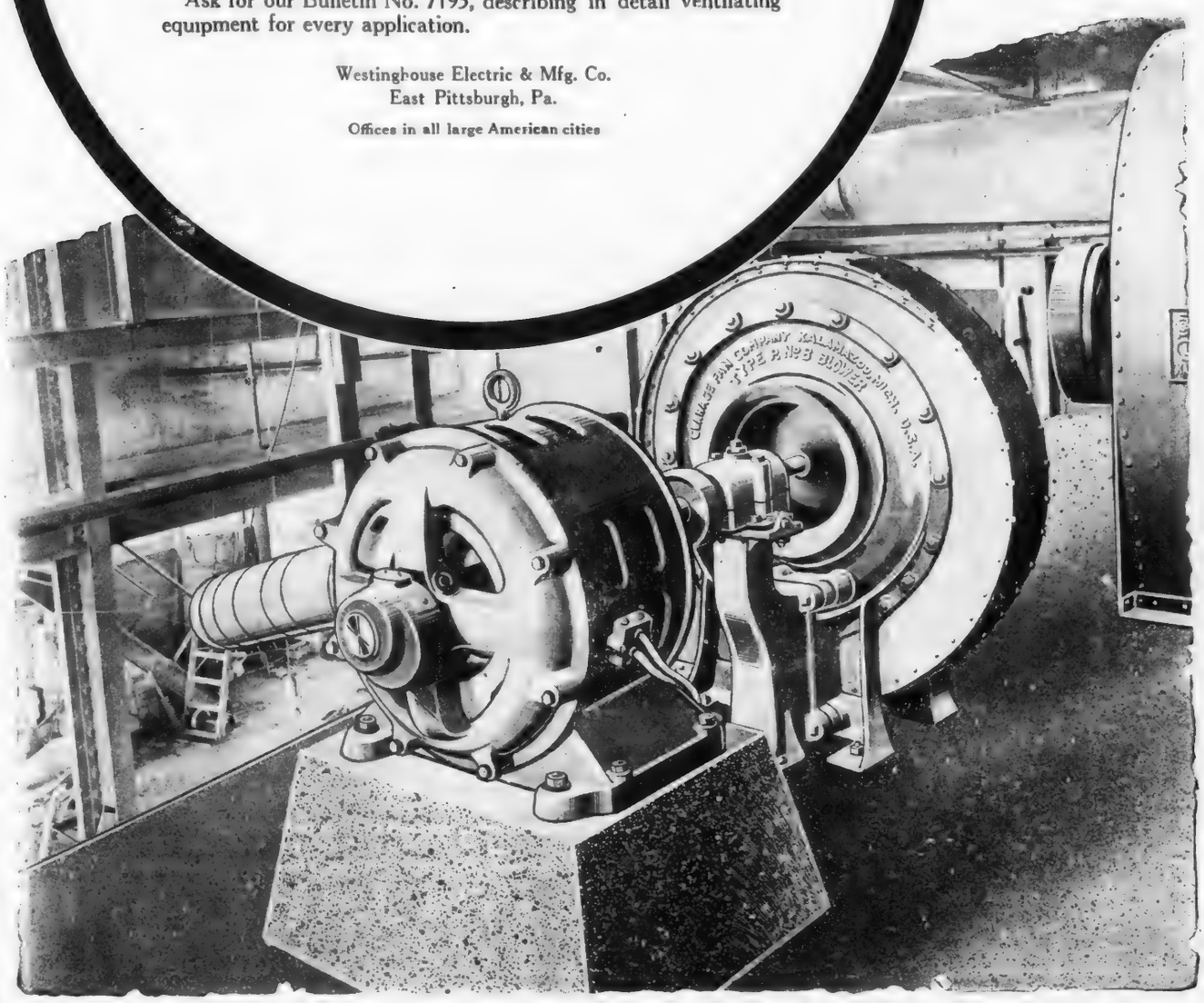
Motors and controllers have been designed for ventilating service in factory, home or school.

Big hotels, such as the Pennsylvania, in New York, and many factories and schools all over the country, are using this equipment and running it continuously day and night with practically no care or attention.

Ask for our Bulletin No. 7193, describing in detail ventilating equipment for every application.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

Offices in all large American cities



ALLEN AIR-TURBINE VENTILATOR

Standard of Ventilating Efficiency

Patented

The Allen Ventilator is an *air-driven* rotating suction turbine. It creates a *mechanically forced action*, precisely the same as expensive steam or electrically driven systems.

Therefore its air displacement capacity is positive, dependable, *measurable and guaranteed.*

But its low initial and installation cost is also the final cost. It *eliminates all operating expense*, care, expert attention and up-keep.

ASK A USER - HE KNOWS

Allen Air-Turbine Ventilators are unaffected by snow, ice, sleet or rain. *They are positively leak-proof*, and the powerful, continuous upward suction flow of air make *down drafts impossible.*

Wherever ventilation is desired—in factories, foundries, stores, schools, hotels, churches, theatres, residences, kitchens, bakeries, tanneries, barns, stables, garages, chimneys, air shafts, or wherever air circulation is required, Allen Air-Turbines *have proven the best, cheapest and most efficient* ventilating system known.

Many of America's largest industrial concerns have adopted and endorse the Allen Air-Turbine Ventilators.

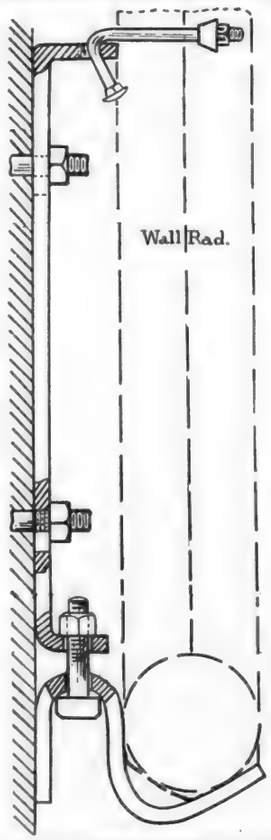
CARRIES OFF
GASES
MOISTURE
STEAM
SMOKE
VAPOR
FOUL AIR
ODORS
HEAT
FUMES
DUST
DAMPNESS

Write for Detailed Literature

ALLEN AIR-TURBINE VENTILATOR CO.
DETROIT MICHIGAN

GLEOCKLE WALL RADIATOR BRACKET

(Patented)



Possesses Advantages of

Universal Adjustment

Ease of Erection

Made of Wrought Iron

Unbreakable

Rustless

Fitting all Makes of Wall Radiators

Available for Immediate Shipment

Write for Descriptive Booklet and Trade Discounts

A. F. Gleockle, Jr.
415 Bay St.
ROCHESTER, N. Y.

Big Contractors Endorse "Toledo" Drives

TOLEDO Power Drives speed up work and cut down overhead. Lord Construction Co., N. Y., says: "These Power Drives have proven eminently satisfactory to us for our cutting and threading work, as we find they not only do their work well, but are very flexible and easily handled." Signed, A. C. Watters, Purch. Dept.

The Toledo Pipe Threading Machine Co., Toledo, O.

N. Y. Office:
50 Church St.

TOLEDO DRIVE
PORTABLE POWER

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Are You Interested

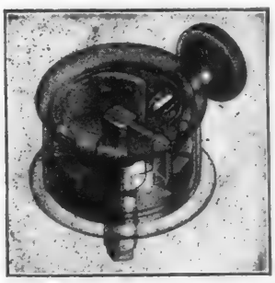
IN A DAMPER REGULATOR THAT

Positively Regulates the supply of hot or tempered air in heating and ventilating systems?

That shows the position of the damper in the pipe and is provided with lettered or numbered cover windows to correspond with the rooms to which the various pipes lead?

That effectively prevents any unauthorized person from tampering with the temperature control adjustment?

That may be placed on the wall of a room where the ventilating ducts are concealed within the wall and the damper connected to it by an extension of the square damper rod?



IF SO, THE

PERFECTO
Damper Regulator and Indicator

is the device you are looking for

Full particulars for the asking

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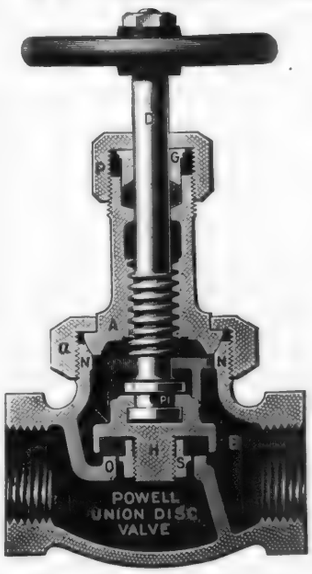
Union Disc

UNION COMPOSITE DISC VALVE

For Steam, Gas, Oil or Air



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Steam Bronze Composition Body and Trimmings

Vulcanized Composition, White Metal or Bronze Discs

Screwed or Flanged Ends

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POWELL UNION DISC VALVES

THE WM. POWELL CO.
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MARSH
RE-ENFORCED PACKLESS
VALVES

Quick Opening

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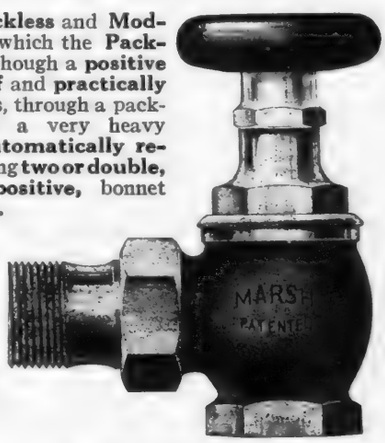
The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically re-enforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**



These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service.**

We specialize on high grade Radiator Valves and furnish the largest line of any company in the business

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100% Fire Proof

INSULATION
FOR
HOT SURFACES

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1 MOST EFFICIENT (by Government tests)
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"More Insulation for Money Invested"

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BUFFALO MULTI-HEAD HEATERS

For forced and gravity circulation heating systems. Installed for such firms as Ford Motor Company, Lincoln Motor Company, American Woolen Mills, Fisher Ohio Body Company, American Can Company, U. S. Government and many others.

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ONLY SIX PARTS

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SOLD WITH AN ABSOLUTE GUARANTEE

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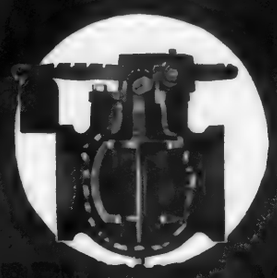

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are designed to maintain a constant back pressure of steam for heating, drying, cooking or other purposes where light pressure is needed. On the exhaust line of a non-condensing engine, the Davis Back Pressure Valve fills the need. For use with condensing engines or turbines the Combination Back Pressure and Exhaust Relief Valve maintains the back pressure when running non-condensing and acts as an exhaust relief when operating condensing. Noiseless and absolutely reliable—cannot stick or bind.

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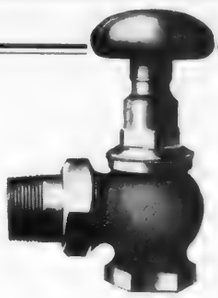

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Packless Radiator Valves

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So well do these valves qualify for efficient service—for handsome design and pleasing appearance—for complete satisfaction, that leading architects, heating engineers and master builders, the country over, recommend and specify them for jobs that require the most careful consideration.

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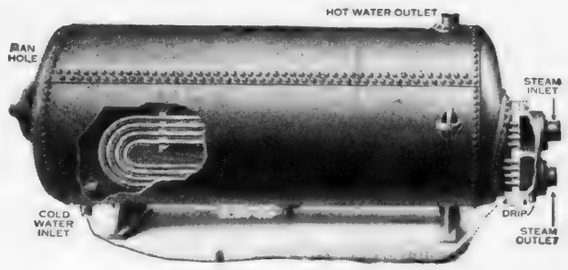

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It is instant, ample, flexible and reliable.

It saves coal, time and money, and insures evener, better results.

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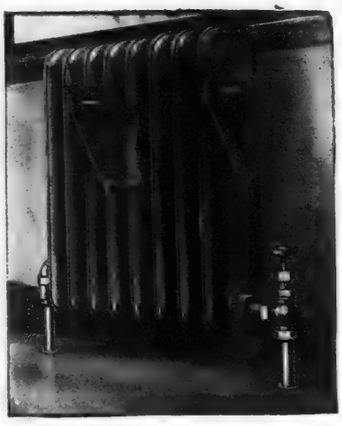

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NO DIRT
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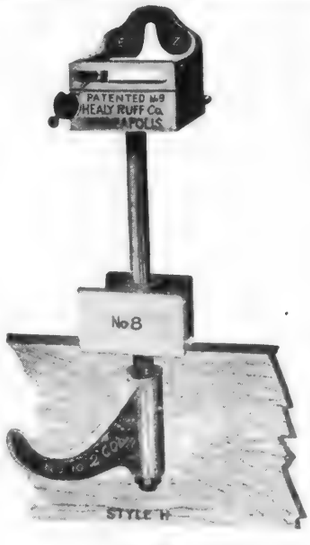

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embodies more original ideas, more advanced engineering, and more good practical features than any other system on the market. The material, construction, installation methods and practical results which, combined, form what we call the RIC-WIL Method, appeal with equal force to the engineer, to the practical operating man and to the business executive. Let us send you a copy of our descriptive Bulletins 1-3.
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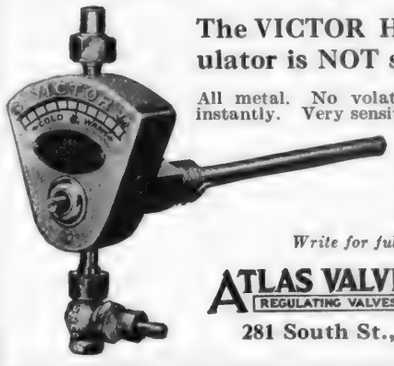

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20% to 40% fuel saving

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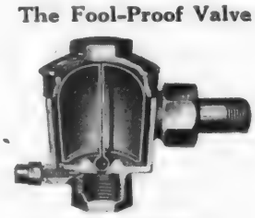

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Mfrs. Peco Vacuum System of Steam Heating and Drying
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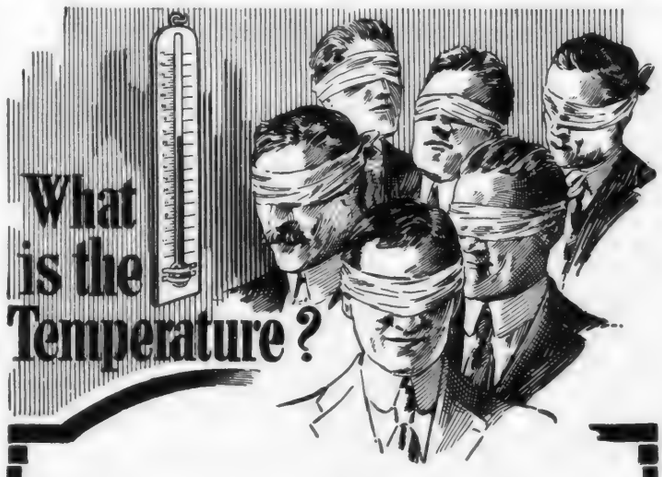

Out of a dozen men who are asked to guess the temperature of anything, not one will be able to give it accurately. Yet some of the largest manufacturing plants—in which heat-treat process forms an important part of the operations—guess at the temperature year in and year out.

Put your heat-treat processes on the same scientific basis as your other processes, by using

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You will then know *exactly* what your temperature conditions are every minute, day and night. They give an absolutely accurate record of the slightest temperature variation—an indelible inscription on a renewable chart, which places in your hands valuable information that enables you to secure perfect temperature control.

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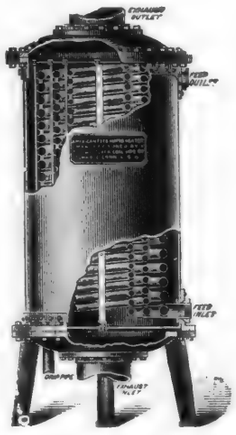

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Heat Water to within 2° of steam temperature

Save 1% of coal for each 11½° rise in temperature

The Type AC Heater (illustrated) is especially adapted to duties where a high final temperature of water is required. It is so designed that every particle of water comes in direct contact with copper heating surface.

"Whitlock Heaters have Everlasting Copper Tubes"

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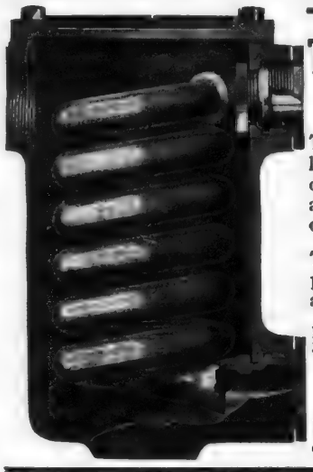
Agents in all Principal Cities



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Eliminates Fire-Pot Pipe Coils

The Excelso Heater, connected below the water-line of steam or vapor boilers, will generate domestic hot water constantly, day and night, as long as there is any fire, at practically no cost.

The copper coil is connected into heater without packing. Made in five sizes for tank capacities as follows:

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30 gal.	45 gal.	70 gal.	90 gal.	120 gal.

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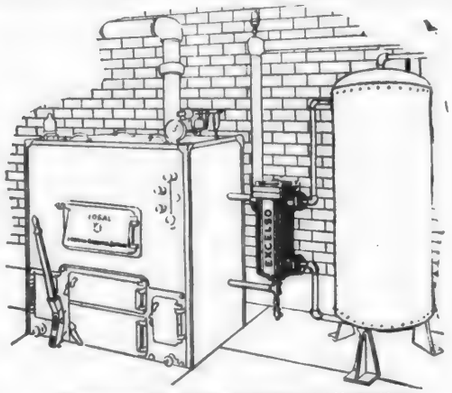

Connected to Ideal Type "A" Boiler

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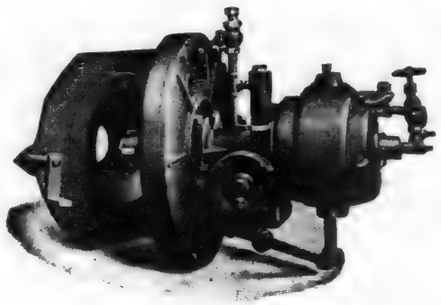

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Adapted to Any Type of Boiler or Furnace

High or Low Pressure, 10 to 300 H. P.

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You obtain all three of these advantages when you use

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Typical installation of Staten's "H.-E." Sectional Steam Conduit

Here is a Steam Pipe Conduit worthy of your notice. Made of thoroughly salt-glazed tile, especially made up in half sections, with roll-frame pipe supports and special conduit insulation installed by us complete, ready for steam pipes.

Complete specifications and estimates of cost furnished upon request.

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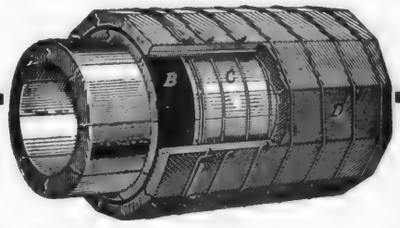

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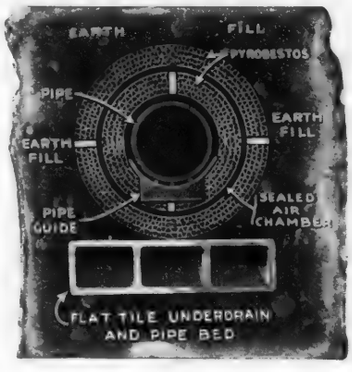

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For piping from central heating plants or power stations to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also an underground Pipe Conduit for heating private Auto Garages direct from House heating systems.

Cannot rot or decay nor will it retain moisture to rust and destroy the piping during non-heating season.

Saves most coal, sends dry steam to a greater distance and by reason of its advanced common sense method of installation is at the same time a lower cost per foot of pipe covered than any other Underground Pipe Insulation on the market.

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Clarage Fan Co., Kalamazoo, Mich.
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Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Patterson-Kelley Co., New York.
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Griscom-Russell Co., New York.
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Underground Specialties Co., New York.
Webster & Co., Warren, Camden, N. J.

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Hackney Mfg. Co., St. Paul, Minn.
Hersh & Bro., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
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New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

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Griscom-Russell Co., New York.

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Griscom-Russell Co., New York.
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Crane Co., Chicago, Ill.
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Jenkins Bros., N. Y.

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Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

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Jas. P. Marsh & Co., Chicago, Ill.
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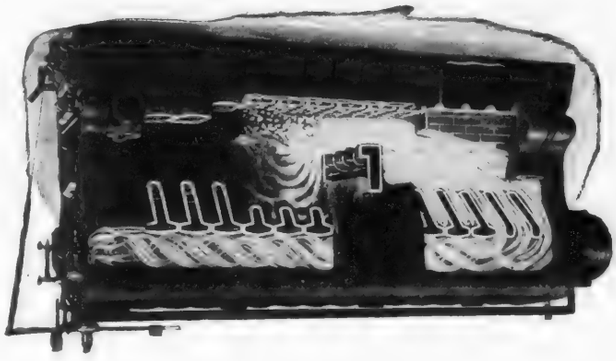

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Skinner Bros. Mfg. Co., St. Louis, Mo.
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Chicago Pump Co., Chicago, Ill.
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United Vacuum Appliance Division, Connersville, Ind
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American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.

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Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Connersville Blower Co., Connersville, Ind.
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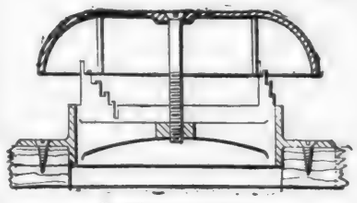
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Illinois Engineering Co., Chicago, Ill.
Johns-Manville Co., H. W., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co, Jas P., Chicago, Ill.
Moline Heat, Moline, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

Return.

American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
McAlear Mfg. Co, Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

Steam.

American Blower Co., Detroit, Mich.
American Dist. Steam Co., No. Tonawanda, N. Y.
Bishop & Babcock Co., Cleveland, O.
Central Station Steam Co., Detroit, Mich.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville Co., H. W., New York.
Kelly Controller Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Patterson-Kelley Co, New York.
Plant Engineering & Equipment Co., New York.
Sarco Co., New York.
Simmons Co., John, New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trane Co., La Crosse, Wis.

Vacuum.

American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N J.

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Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

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Ric-Wil Co., Cleveland, O.
Underground Specialties Co., New York.
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Marsh & Co., Jas P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
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Simmons Co., John, New York.

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Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
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Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.

Balanced.

American Dist. Steam Co., No. Tonawanda, N. Y.
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Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.

Blow-Off.

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Check.

Crane Co., Chicago, Ill.
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Kennedy Valve Mfg. Co., Elmira, N. Y.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.

Gate.

American Dist. Steam Co., No. Tonawanda, N. Y.
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Illinois Engineering Co., Chicago, Ill.
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Detroit Lubricator Co., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
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McDonald Under-Seat Valve Co., Cleveland, O.
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Marsh Valve Co., Erie, Pa.
Pittsburgh Engineering Co., Pittsburgh, Pa.
Simmons Co., John, New York.
Sterling Engineering Co., Milwaukee, Wis.
The Wm. Powell Co., Cincinnati, O.
Trane Co., La Crosse, Wis.
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Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
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Fulton Co., Knoxville, Tenn.
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Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Plant Engineering & Equipment Co., New York.
The Wm. Powell Co., Cincinnati, O.

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American Dist. Steam Co., No. Tonawanda, N. Y.
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Hersh & Bro., Allentown, Pa
Garden City Fan Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Moline Heat, Moline, Ill.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F, Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

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American Ventilating Co., Pittsburgh, Pa.
Batterman-Truitt Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Buckeye Blower Co., Columbus, O.
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Johns-Manville Co., H. W., New York.
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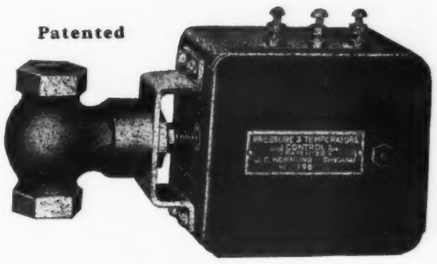

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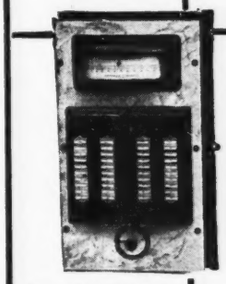

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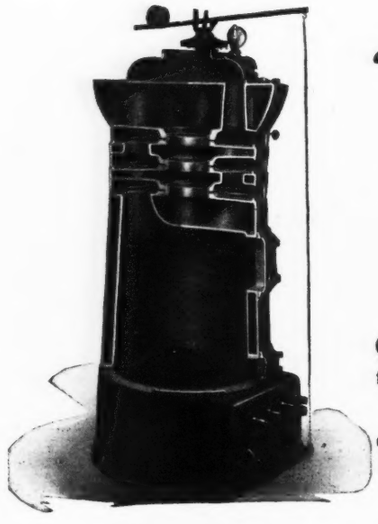

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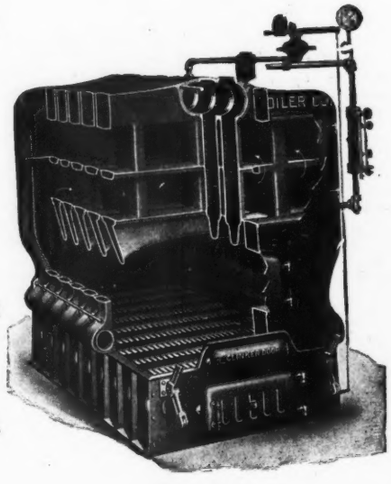

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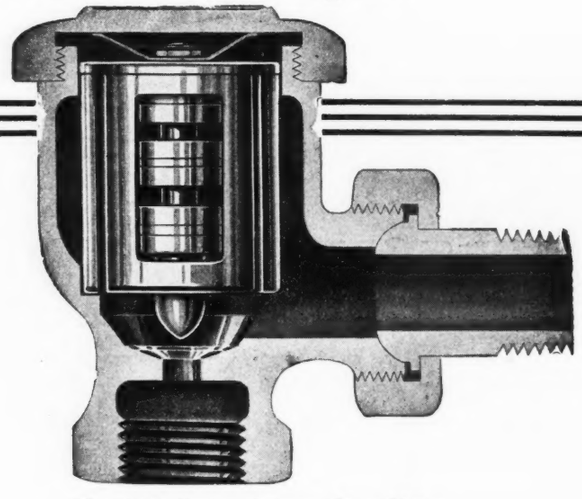

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